THE PAPER INDUSTRY and PAPER WORLD

JUNE, 1941 — VOLUME 23 — NUMBER 3

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DEFENSE AND THE FUTURE...

Copy of Letter to users of Products of The International Nickel Company, Inc.

The International Nickel Company, Inc.

EXECUTIVE OFFICES: 67 WALL STREET

ROBERT C. STANLEY,
PRESIDENT.

New York, April 17, 1941.

Dear Sir:

Our plants, in common with those of most of America's industrial units, are working at their peak on defense production. In spite of this, hardship is being inflicted upon many consumers of our products who in the past have aided us in building a great business, and upon whom we must depend for our future success.

As this letter is written the monthly production rate of The International Nickel Company of Canada, Limited is already 20% above last year; three times that of 1929 and four times the peak rate of the last war. Its facilities have been increased to supply current defense demand and further increase in output will be available this year.

Upon the conclusion of this devastating war the future success of your business and ours will depend in large measure upon the retention of the good will of our customers. Any effort we can make, not conflicting with our full support of the defense program, should be directed toward this vitally important objective.

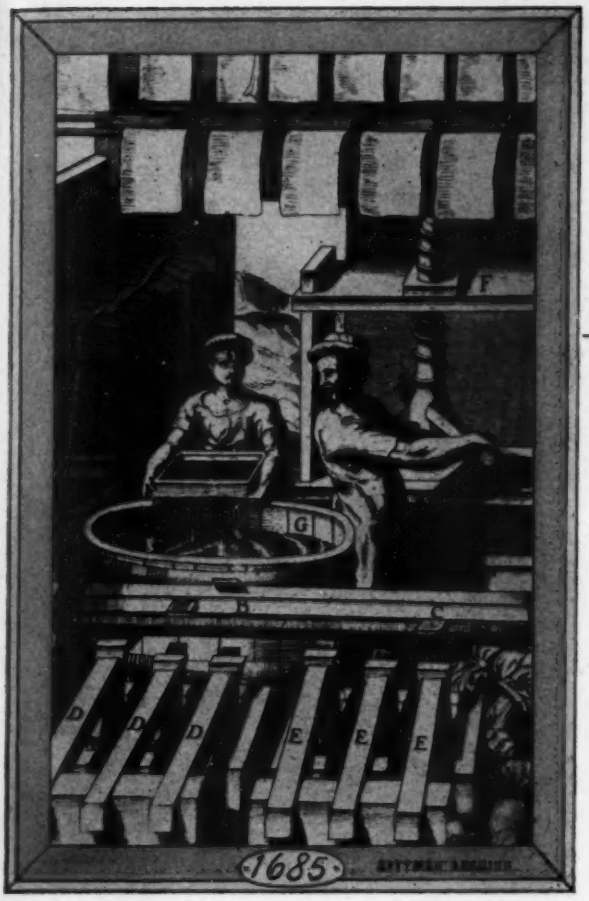
To this end we wish to offer our services especially to those customers whose requirements cannot for the moment be filled. One practical means of rendering such service is to offer you the assistance of our technical staff in solving problems of material arising from the temporary lack of nickel.

Our problems are complex and constantly changing and can only be solved through cooperation. As we see it, a large part of the solution lies in making clear the situation which we face. Your help and advice will be of invaluable assistance. It is our purpose to follow this letter with a personal call from one of our representatives, if you so desire, who will discuss with you in more specific detail our mutual problems.

Yours very truly,

RCS:JJB

PRESIDENT.



Papermaking

HAS COME A LONG WAY SINCE THE 17th CENTURY

make APPLETON FELTS good paper

Then it was the art of papermaking. Now it is an industry. Individual production—sheet by sheet—has been replaced by machines that produces tons. Even in the 17th century felts had an important part in papermaking. Felt layers were used to remove the water from the paper sheets, that were put between the felt layers and pressed. As the art of papermaking grew into an industry, progress was made in felt making. Year after year this progress has kept pace with the progress in papermaking. And, since 1890 Appleton Felts have met all requirements of paper mill production—today preferred by mills because Appleton Felts make good paper.

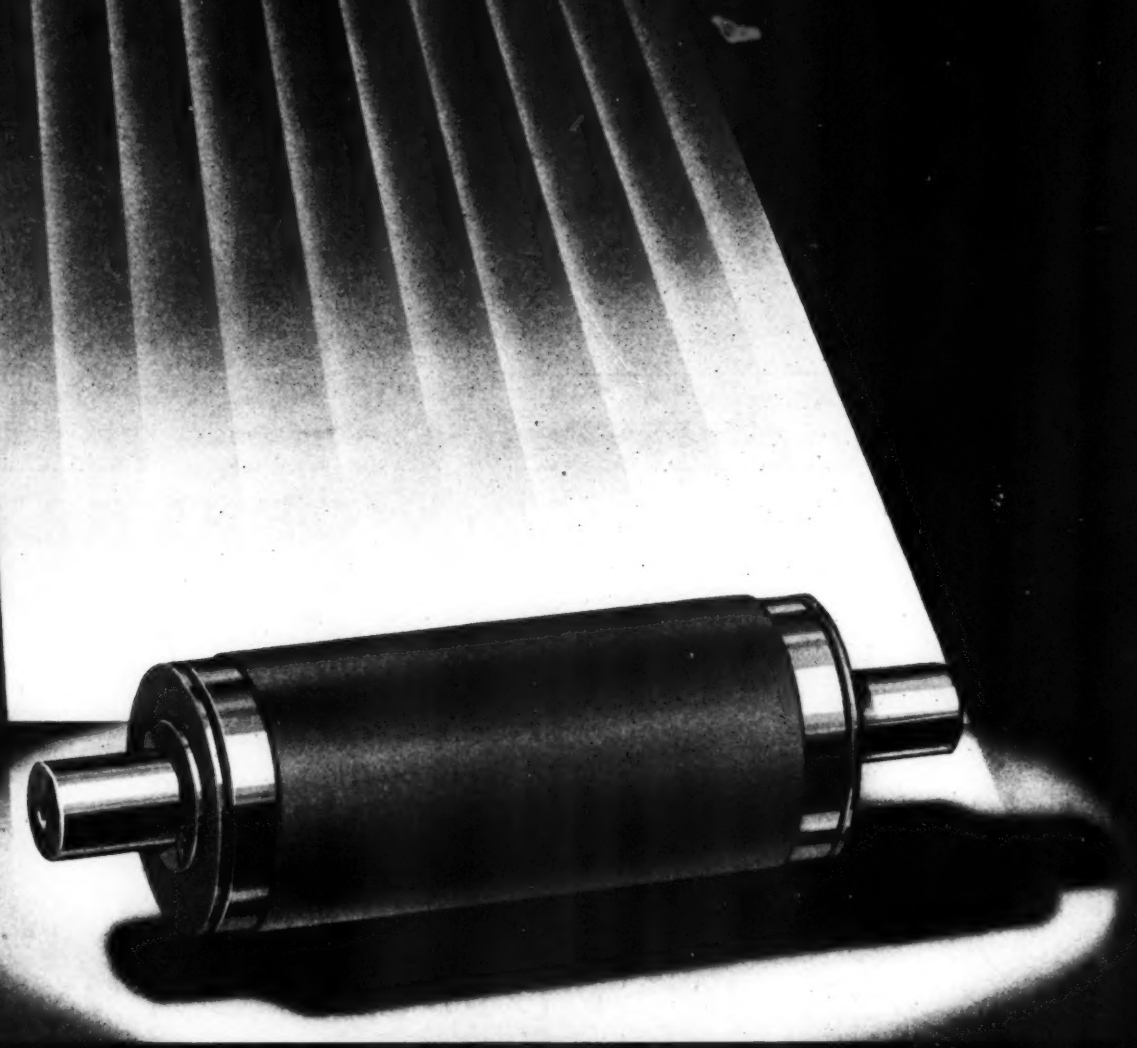
This is one of a series of six advertisements illustrating the early history of papermaking.

Appleton Woolen Mills

APPLETON • WISCONSIN

PERKINS

Serving the PAPER INDUSTRY
surpassingly well since 1873



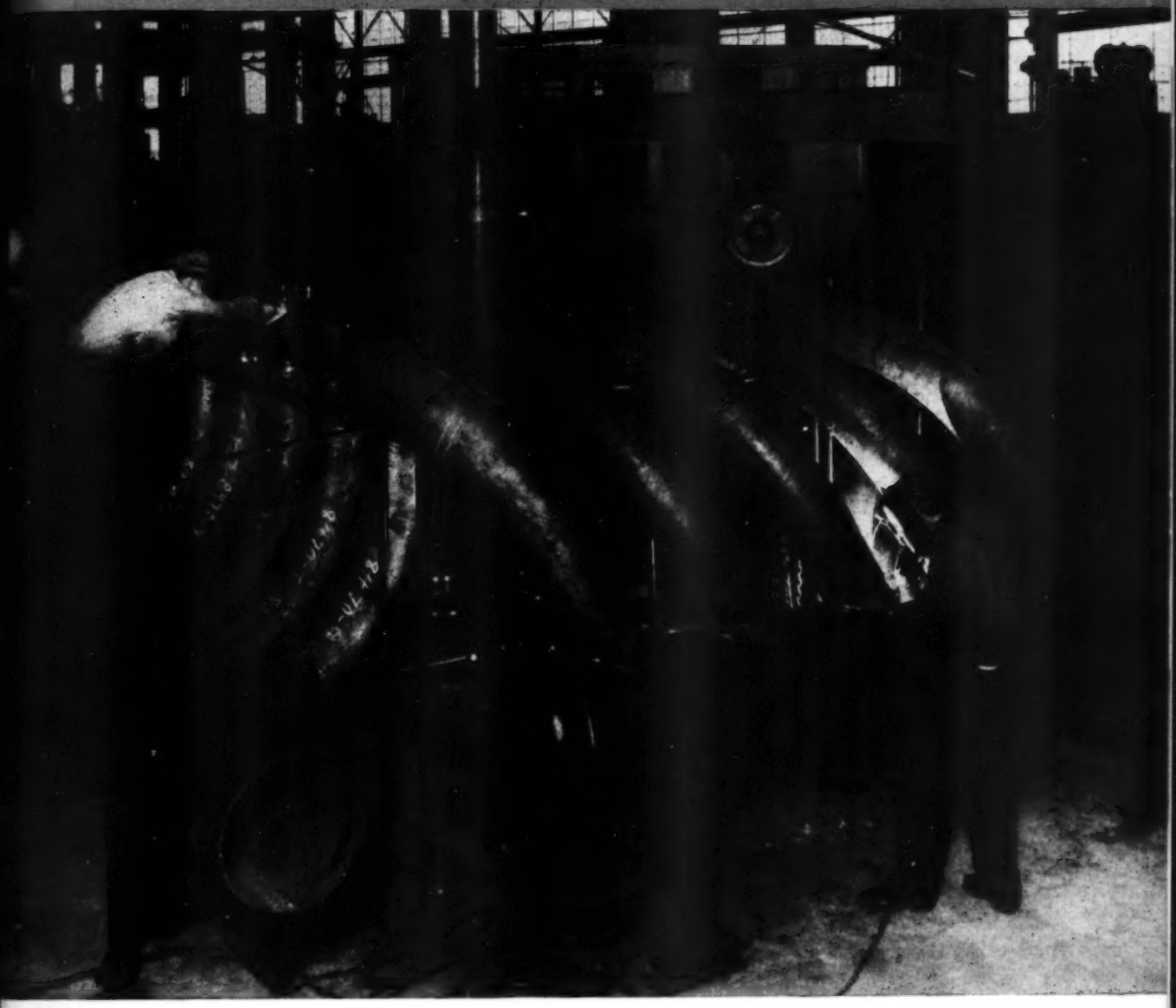
B. F. PERKINS & SON, INC.

ENGINEERS AND MANUFACTURERS

HOLYOKE • • • MASSACHUSETTS

HOLYOKE • • • MASSACHUSETTS

Here's What We Mean By "KNOWING HOW"!



The plans called for special, heavy duty headers. The specifications were tough . . . predetermined strength . . . difficult curves and angles . . . exacting thermal characteristics . . . dimensional precision . . . delivery on a tight schedule.

Grinnell engineers have plenty of experience in handling these complicated assignments. Rough layouts of plant requirements were immediately interpreted in terms of alloy steel piping, accurate forming and welding, margins of safety, and underwriters' inspection. Conveniently located Grinnell plants then speedily prefabricated these and other subassemblies. And, promptly on delivery date, the complete installation was on the job . . . ready for erection.

This is only one of many examples of "knowing how" that prompts leading engineers to say, "Give the plans to Grinnell"! Write for detailed manual on Grinnell Prefabricated Piping. Grinnell Co., Inc., Executive Offices, Providence, Rhode Island. Branch offices in principal cities of United States and Canada.

PREFABRICATED PIPING BY **GRINNELL**

WHENEVER **PIPING** IS INVOLVED

Easy to install and remove, SKF Spherical Roller Bearings on this Great Northern Pulp Grinder, built by Montague Machine Company, have a tapered bore mounted on a tapered sleeve. This eliminates costly shaft shoulders . . . minimizes the time the grinder is out of commission.

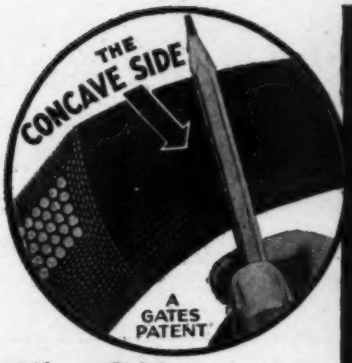
Taking It

ON PULP GRINDERS

Grinding pulp is a pretty BIG job in the Paper Industry. And down on the 11 7/8" diameter shaft of this Great Northern Pulp Grinder where brute stresses are imposed by heavy pressure in the pockets as well as the weight of the stone and the shaft, you spell BIG in capitals. That's where sturdy SKF Spherical Bearings take loads up to 75,000 pounds at 240 r.p.m. . . . where SKF Pillow Blocks keep pulp and water from molesting the bearings. On *your* BIG jobs . . . and jobs that aren't so *big* . . . SKF's are used. 4796

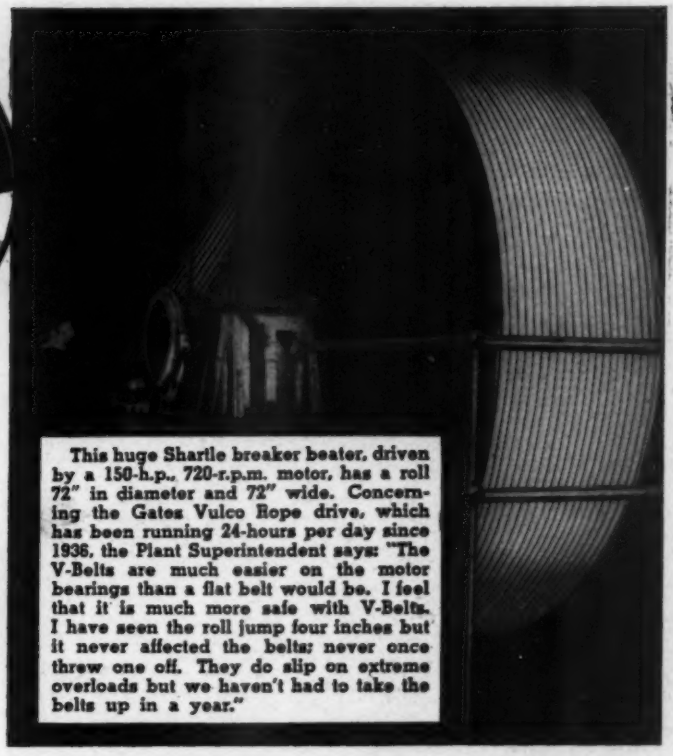
SKF INDUSTRIES, INC., FRONT ST. & ERIE AVE., PHILA., PA.

ROLLER **SKF** BEARINGS

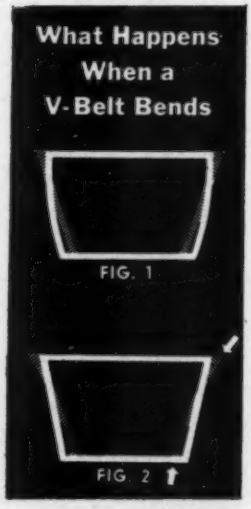


In Two Minutes
This Easy Test

Will Show You
How to
SAVE MANY DOLLARS !



This huge Shartle breaker beater, driven by a 150-h.p., 720-r.p.m. motor, has a roll 72" in diameter and 72" wide. Concerning the Gates Vulco Rope drive, which has been running 24-hours per day since 1936, the Plant Superintendent says: "The V-Belts are much easier on the motor bearings than a flat belt would be. I feel that it is much more safe with V-Belts. I have seen the roll jump four inches but it never affected the belts; never once threw one off. They do slip on extreme overloads but we haven't had to take the belts up in a year."



It's very easy to learn for yourself how a V-belt with a concave side saves your money.

Just take any V-belt and bend it (as illustrated in the photo above). As the belt bends, grip its sidewalls between your finger and thumb. You will feel those sides bulge outward.

If the belt is a straight-sided belt this bulging gives it a shape like that shown in figure 1 (on the left). Clearly this shape does not fit the sheave groove.

But when you bend a belt that is built with the patented Concave side, you find that the sides become perfectly straight—as shown in figure 2. Here are the advantages: This shape exactly fits the sheave groove; this means uniform sidewall wear—longer life for the belt. Also, the full side of the belt is gripping the pulley, which means less slippage—a saving in belt wear and also in power.

The concave side is a Gates patent. Only belts built by Gates are built with the concave side.

THE GATES RUBBER COMPANY

Engineering Offices and Stocks in All Large Industrial Centers

GATES VULCO ROPE DRIVES

CHICAGO, ILL. 1524 South Western Ave.
HOBOKEN, N. J. Terminal Building
BIRMINGHAM, ALA. 1631 1st Ave., South
LOS ANGELES, CAL. 2240 E. Washington Blvd.
DENVER, COLO. 999 South Broadway
DALLAS, TEX. 2213 Griffin Street
PORTLAND, ORE. 333 N. W. 5th Avenue
SAN FRANCISCO, CAL. 2700 16th Street

Nature Gave Us Air Conditioning

Air conditioning is effected through a process of washing, humidifying, and dehumidifying the air. Nature perfected this system through its streams, the soil, and its forests.

Regional Research Laboratories

▸▸▸ ONE OF THE MOST IMPORTANT and far-reaching movements undertaken by the Bureau of Agricultural Chemistry and Engineering of the United States Department of Agriculture has been establishment of four new laboratories. These fine institutions will be devoted to research and scientific study looking toward a broader and more efficient utilization of farm products than has been considered heretofore.

Two or three decades ago, no one would have thought that some day agriculture would be looked to as a supplier of industrial raw materials. But scientific research has discovered many important uses for farm products and the utilization of agricultural residues is in its infancy. Pioneers in this gigantic movement included that group of agricultural scientists who, within the past decade, formed a band known as the Chemurgic Council. This group of thinkers is credited with having developed within the minds of the public the idea of using farm products on a commercial scale.

This is but one of the Government's ways of helping the farmer. Instead of subsidizing the farmer, it intends to use every scientific means to bring the farmer and industry closer together and to develop new uses for his crops; to get his raw materials converted into products needed for industrial purposes. To do this, two things must be done: (1) these products must first be developed, and (2) industry must use these products. These laboratories, then, will be engaged in what might be termed "market development research."

The Department of Agriculture has been searching for industrial uses for farm products in a limited way for 25 or 30 years, and has made some very creditable accomplishments during that period. Congress became so interested in this industrial utilization idea that in 1938 it appropriated four million dollars to establish four Regional Research Laboratories, one in each of the major farm producing areas of the country to search for new and wider industrial outlets and markets for farm products.

Following are the locations of the four laboratories and the farm commodities to be initially investigated at each:

Northern—This laboratory, located in Peoria, the second city of Illinois, will conduct research work having to do with wheat, corn, and agricultural residues. Dr. O. E. May is the director.

Eastern—Located in Philadelphia, this laboratory will study tobacco, apples, Irish potatoes, dairy products, vegetables, animal fats and oils, hides, and tanning materials. The work here is headed by Dr. P. A. Wells.

Southern—New Orleans is the home of this laboratory where the study of cotton, peanuts, and sweet potatoes will be directed by Mr. D. F. J. Lynch.

Western—At Albany, California, Dr. T. L. Swenson will head the work in studying fruits, vegetables, Irish potatoes, wheat, alfalfa, and poultry products.

The laboratories are all built after standardized plans. Therefore, a description of the laboratory recently occupied at Peoria, Illinois, mentions many features that are incorporated in the others.

Northern Regional Research Laboratory

This laboratory is located in one of the most beautiful sections of this Illinois city. The building is U-shaped and is 211 feet across the front. The sides, or wings, of the U are 280 feet deep. One of these wings is completely occupied with sixty research laboratories equipped for work in chemistry, physics, and biology. The laboratories and offices are air conditioned. A refrigerating plant is operated from the power plant at the rear of the laboratory. The other wing of the U is devoted to a pilot plant which extends up through the four stories from the basement floor level. This section is divided into two parts: In one section will be conducted investigations on liquid, solid, and gaseous motor fuels derived from agricultural commodities. The other will be devoted to pilot plant scale development of other products and processes developed in the chemical laboratories. There is also a separate service building containing the steam boilers for heating the buildings and supplying process steam, and the air conditioning and refrigeration equipment.

The work at the laboratory will be carried on under the following eight divisions:

Agricultural Motor Fuels Division—Mr. S. T. Schicktanz, Chief.

Agricultural Residues Division—Dr. E. C. Lathrop, Chief.

Analytical and Physical Chemical Division—Dr. Reid T. Milner, Chief.

Commodity Development Division—Mr. J. H. Shollenberger, Chief.

Engineering and Development Division—Dr. C. T. Langford, Acting Chief.

Fermentation Division—Dr. R. D. Coghill, Chief.

Oil and Protein Division—Dr. R. H. Manley, Acting Chief.

Starch and Dextrose Division—Dr. G. E. Hilbert, Chief.

On July 1, the staff and equipment that has been maintained by the Bureau of Agricultural Chemistry and Engineering at the Agricultural By-Products Laboratory at Ames, Iowa, in co-operation with the Iowa State College, will be moved to the new laboratory at Peoria.

Agricultural Residues Division

Special processing and testing equipment for the development of new industrial uses of agricultural residues is now being installed by this Division. Dr. Elbert C. Lathrop, Chief of the Division, is well known in the paper industry. He has held important positions in the chemistry field with the E. I. du Pont de Nemours Company,

S. P. Sadtler & Son, Inc., the Celotex Corporation, and the Crown Zellerbach Corporation. He has won recognition as an authority on the commercial production of cellulose products. This Division will be divided into three sections, with specialists in charge of each who will work under Dr. Lathrop:

1) Pulp and Paper, to be in charge of Dr. S. I. Aronovsky, who is being transferred from the Agricultural By-Products Laboratory at Ames, Iowa.

2) Plastics and Building Materials, in charge of Dr. R. V. Williamson, recently in charge of research for the McCloud River Lumber Company, McCloud, California.

3) Hemicelluloses and Lignin, in charge of Dr. Darrell Althausen, formerly research supervisor at Hiram Walker and Sons, Inc., distillers.

Plans for the work of the Laboratory have been, and will be guided largely by advisory committees of expert scientists from Federal, State, and educational institutions. The Department of Agriculture also hopes for, and will welcome, the fullest possible co-operation from industry.

◆

SORG PAPER CO. COMPLETES TWO PROPERTY DEALS

The Sorg Paper Company, Middletown, Ohio, recently completed two real estate deals on properties owned by the company in Middletown. The United States Government has leased the building, formerly occupied by the Advance Bag & Paper Company, Inc. on Broad Street and later used by the Sorg Company for its Superior-Lawrence Bag Division, to be used for the headquarters of the Civilian Conservation Corps, Ohio-West Virginia District, Fifth Corps.

This building, with a floor area of approximately 175,000 square feet, will be used as a reclamation post and also as a supply depot for 110 CCC camps in the Fifth Corps. It is estimated that over 200 persons will be employed, most of whom will be transferred from Columbus, Ohio.

The second real estate transaction was the selling of the building located on Grand Avenue to the Interstate Folding Box Company, Middletown. The Sorg Company obtained this building, with a floor space of 118,000 square feet, in 1936 when the assets of the Lawrence Bag Company were bought. This building had also been occupied by the Advance Bag & Paper Company. Both of the buildings, before the transaction, were used as warehouses for storing pulp and finished paper.

AUSTRALIAN NEWSPAPERS PRINTED ON NEWSPRINT FROM EUCALYPTUS

Nine metropolitan newspapers in Australia printed their issues of May 12 and 13, 1941, on newsprint made in Australia from Australian hardwood.

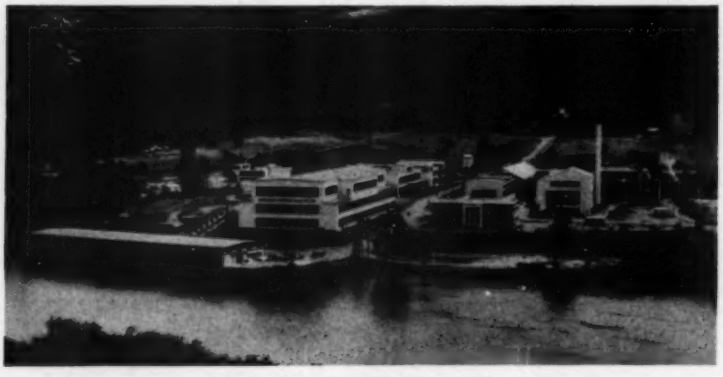
The newsprint used in this epochal run was manufactured at the new paper mill of the Australian Newsprint Mills Pty., Ltd., at Boyer, in the peaceful Derwent Valley of Tasmania, a few miles north of Hobart. Newsprint was run at this mill for the first time on February 22, 1941.

Just what this means to Australia must be considered in the light of world conditions. Also it must be pointed out that previously all newsprint was imported by Australia because it had been thought impossible to manufacture newsprint from the native hardwoods.

More than 20 years ago, the newspaper publishers of Australia became highly interested in developing the natural resources of that country to the fullest extent of their needs, and through their assistance a research program was instituted at Perth (Western Australia) by the Commonwealth Institute of Science and Industry. From that time, eucalyptus, native Australian hardwood, became the subject of a long period of scientific research. Despite many obstacles and setbacks, this development has brought results. First, white and other printing papers were made from eucalyptus pulp, and now through several stages has come the greatest achievement of all—that of making newsprint commercially from eucalyptus.

In 1932, the newspaper companies became associated with the movement which has resulted in the building of the fine new mill at Boyer, and Australia now has taken on industrial impetus and can supply its own pulp requirements.

The Australian News & Information Bureau states that in Tasmania there are 400 square miles of forest available at present for pulpwood. The capital now invested there by Australian interests amounts to £1,600,000, and the first year's output of the Boyer mill has been estimated at 27,000 tons. Later it is expected that capital of £4,000,000 will be involved when the projected production of 108,000 tons is reached. The projected total is expected to be sufficient to meet Australia's war-time requirements.



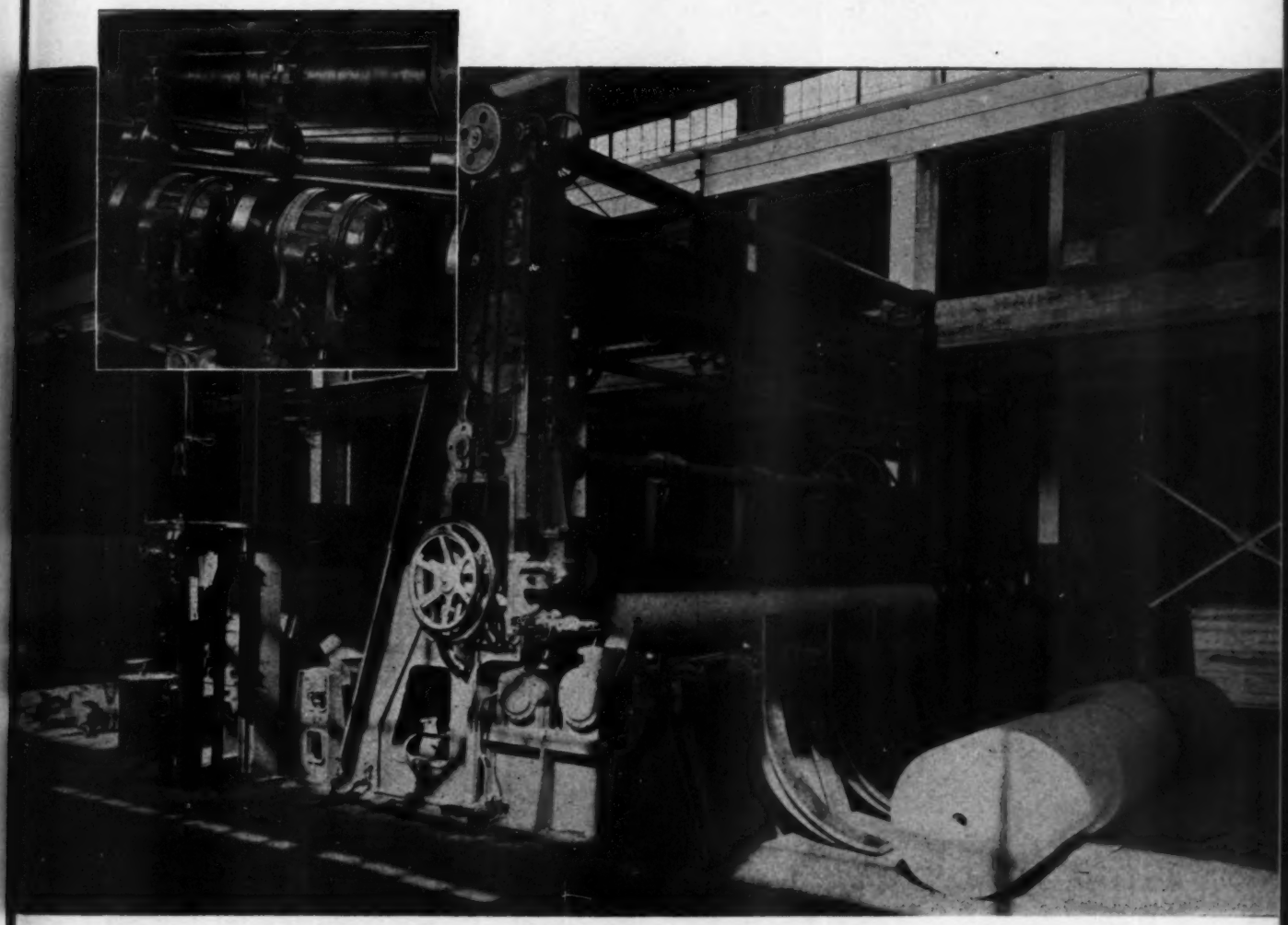
View of the new newsprint mill at Boyer, near Hobart, Tasmania.
(Courtesy Editor & Publisher)

NEW PROPOSAL MAY END RECEIVERSHIP AT LAKE SULPHITE

At a meeting held in Montreal on May 22 of the varied interests in the Lake Sulphite Pulp Company, Ltd. (Red Rock, Ontario), now in receivership, consideration was given to what was described as the first practical proposal for dealing with the unfinished undertaking since it went into receivership in February of 1938. The proposed transaction, it was stated following the meeting, would involve the sale of assets to a new company which would be controlled by a group of Michigan paper mills. Under the terms of the proposal, it was added, the full capacity of the plant would be assured over a long period of years.

Under the proposed deal, approximately $4,000,000 more would be required to complete the plant. On this basis, the capital of the new company would amount to $8,000,000. To make this transaction feasible, it was pointed out, the full co-operation of the Dominion Government, the Province of Ontario, and all those interested in the company is necessary. If the details can be worked out, construction would begin this summer and the plant would be placed in operation in June, 1942.

Winder keeps pace with modern high-speed machines



This improved Puseyjones Winder for high-speed paper machines is one of six all-purpose Winders now in successful operation. A seventh unit is now under construction . . . Smaller illustration shows the Slitting Attachment with shear cut slitters.

The improved Puseyjones Winder for all-purpose machines gives you the necessary speed-up in the winding operation and meets the commercial demand for larger shipping and converting rolls.

Operation is simplified by the latest mechanical improvements, including an individual motor drive for the rider roll and for each drum and a time-saving shaft replacement device. Slitters operated by individual motor drive have a pneumatic throw-off device for easy adjustment.

The unloading of finished rolls is accomplished with an improved push-out device and roll dumping table, both motor-operated.

Now is the time to replace conventional winding equipment with the improved Puseyjones Winder. Designed to speed up the winding operation, increase roll diameters and maintain continuous and uniform production at the highest manufacturing speeds.

Let us give you full details.

THE PUSEY AND JONES CORPORATION

Established 1848. Builders of Paper-making Machinery. Wilmington, Del.

THE SIGN OF TRADE MARK SUPERIOR QUALITY

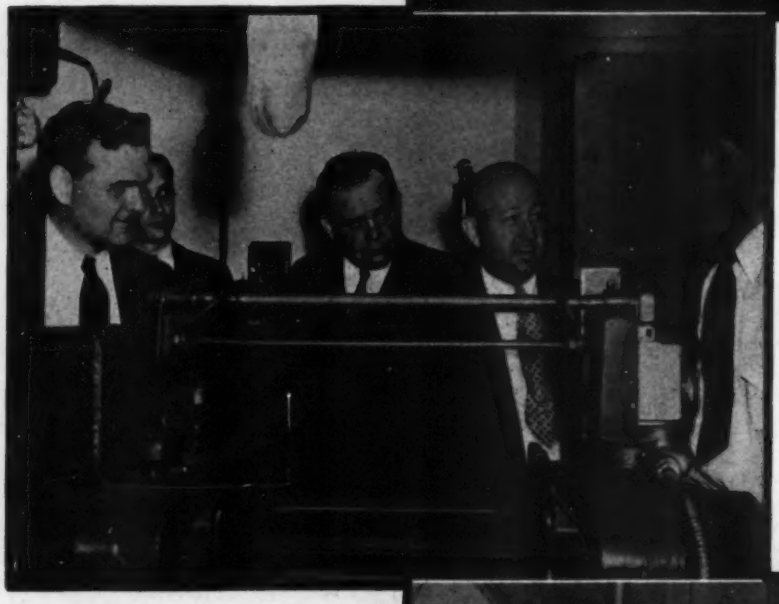
MEMBERS ATTEND SIXTH CONFERENCE AT THE INSTITUTE

Over 100 executives of member mills of the Institute of Paper Chemistry attended the sixth annual Executives Conference held on May 22 and 23 at the Institute in Appleton, Wisconsin. Upwards of 150 attended the banquet on Thursday evening at which time Dr. Don D. Lescohier of the University of Wisconsin was the speaker. Dr. Clarence A. Dykstra, who had been engaged to speak, was detained in Washington.

The conference opened with registration and the traditional tour of the Institute during which time the executives inspect new additions and equipment and observe students working on their theses. At noon Sidney D. Kirkpatrick, editor of *Chemical and Metallurgical Engineering* and vice president of the American Institute of Chemical Engineers, was the speaker at a luncheon at North Shore Golf Club. Student discourses were heard Friday morning and following another luncheon Friday noon.

During off hours on both days the annual executives golf tournament was held at North Shore. At the Friday evening dinner Henry P. Carruth, manager of the Brown Company, Berlin, N. H., was awarded the golf trophy for a net score of 75.

A meeting of the board of trustees was held the evening prior to the conference.



Reading left to right:

Above—Jack Kimberly (Kimberly-Clark Corp.); D. S. Leslie and R. P. Price (Hamilton Paper Co.); conversing in lobby of the Institute during the opening morning tour.

Left—Robert Canfield (Groundwood Paper Manufacturers Ass'n, New York); Gilbert Barnes (Institute staff); L. W. Strattner (West Virginia Pulp & Paper Co.); Roland W. Richardson (Gardner-Richardson Co., Middletown, Ohio); Isaac R. Dunlap (Institute staff); inspecting equipment in the optical laboratory.

Below—Sidney D. Kirkpatrick, editor of *Chemical and Metallurgical Engineering*; M. Filius and K. Huse (Eastman Kodak Company) in one of the laboratories on a tour of the Institute.

Reading left to right: Left—Norman S. Stone (Mosinee Paper Mills); and L. H. Reed (Southern Kraft Corp.) shown during annual executives golf tournament at North Shore Country Club at Appleton. Right—Folke Becker (Rhinelander Paper Co.) and W. H. Swanson (Kimberly-Clark Corp.) president of TAPPI, waiting to tee off at the golf tournament.

M AND O TO BUILD NEW TEST PLANT

After seven years of successful laboratory research by the University of Minnesota in the utilization of aspen wood, the Northwest Research Foundation announces the construction of a "pilot plant" to begin commercial production on a small scale of alpha-cellulose, basic raw material for the manufacture of rayon, munitions, celluloid, plastics, and similar products. The foundation concluded an agreement with the Minnesota & Ontario Paper Company for the construction of the "test" mill at International Falls, on the Canadian border.

The Northwest Research Foundation was organized by civic-minded men in 1933, with the sole purpose of developing natural resources of the State. The laboratory work on the development of alpha-cellulose marks the completion of the first major step in its history. Many other projects are being experimented on by this organization.

Work on the plant will start immediately, with the completion date set within three to six months. Production will run approximately 500 pounds of cellulose a day. This new mill will mark the half-way point between the tests conducted in the laboratory to the time when the product is manufactured on a large scale for utilization by large chemical firms of the country.

Probably the most important use that alpha-cellulose will have in industry, at the present time, will be in the manufacture of munitions for the defense program, but it will also play an important role in industries manufacturing rayon, plastics, lacquers, photo films, etc.

The M & O Paper Company will finance the construction of the plant which will be used to prove that this "raw material" can be furnished in large quantities. Selection of the M & O Paper Company to conduct further research was made by the foundation, on account of the location of the mills in the center of the aspen forest supply and also because of the availability of the water supply. The same type of machinery now being used in the mill is suitable for the production of the alpha-cellulose on a large scale, should research on the "pilot plant" prove successful.

The manufacturing process of alpha-cellulose is comparatively simple. After removal of bark, the aspen logs are cut into small chips. The chips are chemically treated with nitric acid and caustic soda and chlorine is used to bleach the pulp. A large volume of water is needed to insure purity. The finished pulp is an acceptable raw material for the production of other cellulose products.

One of the interesting features of this process is the by-products which can be recovered, including acetic and oxalic acid. Both are commodities in wide use and their recovery will increase the value of the operation.

A fairly large alpha-cellulose plant would use 100,000 cords of aspen a year. The supply of aspen is almost inexhaustible for each year more aspen reaches merchantable size.

PAPER MONEY TO GET WEAR-OUT TEST

Co-operative research carried out by the Bureau of Standards and the Bureau of Engraving and Printing has resulted in the development of an artificial wearing-out test to be applied to paper currency to determine in a few minutes the same results that come from long use of currency in circulation. The test, developed by F. T. Carson and Vernon Worthington, is particularly adapted to determining the relative wearing quality of a given type of paper that has been treated in various ways to improve its performance.

This is a matter of importance, since the Federal Government spends several million dollars annually in replacing worn out currency. Service tests of paper currency in circulation require a great deal of time and it is difficult to get adequate returns on comparable treatments. Therefore, a quick laboratory test that will simulate the kind of treatment that paper currency gets in circulation is an important achievement.

The test is made in two stages. First, a square of paper is crumpled to a certain volume by means of a piston working in a cylinder, then the paper is removed by mechanical fingers, straightened, and then put through the same process again. This is repeated many times until the sample looks and feels like currency that has been in circulation for several months.

In the second stage of the test, the damage to the paper sample is deter-

mined. Strength and stiffness are sometimes measured, but the most valuable criterion of the change in the paper has been found to be the increase in the rate at which air will flow through it under a given pressure. This test shows how much the structure of the paper has opened up. This second stage is accomplished by means of a new air permeameter especially designed for the purpose.

◆

H. S. STUDENTS TAKE TRAINING IN PAPERMAKING

An experiment to test the value of industrial training when combined with education has been instituted in Holyoke, Massachusetts. It is fitting that this plan should be started with training in papermaking, since Holyoke is definitely a papermaking city.

As a part of their regular course, six seniors in the Holyoke High School have been studying papermaking, and better still have been paid for it. These boys have been spending their afternoons and Saturday mornings working in the laboratory, office, and mills of the American Writing Paper Corporation.

The plan originated when an authority high up in school matters brought the subject to the attention of Edward C. Reid, vice president of the American Writing Paper Corporation. This, of course, led to the choice of AWP for the experiment, which will go down in the company's history. When school opens next fall, it is hoped the plan may be broadened, and that it may spread to other industrial concerns in Holyoke.

◆

MEXICO TO BUY 30,000 TONS OF NEWSPRINT PAPER

Mexican purchasers will buy approximately 30,000 tons of newsprint paper this year, it was recently announced by A. B. Muddiman, Canadian Trade Commissioner at Mexico City. Of this amount, some 7,500 tons have already been purchased. Arrangements are in progress for Mexican representatives of newspaper publishers to visit Canada and Newfoundland to purchase the remaining 22,000 tons to be ordered this year.

The paper that has already been bought was received from two different sources; 2,000 metric tons at an approximate price of $62 c.i.f. Vera Cruz and 500 tons of rotogravure at $77.50 c.i.f. Vera Cruz were purchased from Finland. The balance, 5,000 tons, was obtained from Canada.

FINANCIAL

Mixed trends in the securities markets are indicated by trading during May, with some paper mill securities showing strength, and others trending downward as compared with values at the end of April.

American Writing Paper Corporation—Net profits for the first quarter of 1941 were $57,712, as against $9,880 for the same period in 1940.

Certain-teed Products Company—Net earnings for the March quarter were $143,264 as against $149,062 in 1940.

Continental Diamond Fibre Company—Net earnings for the first quarter were $153,103 as against $168,378 for the same period of 1940, but the 1941 reserve for income taxes and contingencies was $230,000 as compared with a reserve of $36,000 in 1940.

Eastern Corporation—Net earnings for the first quarter of 1941 were $103,087 as compared with $195,000 for the year 1940.

Flambeau Paper Company—Net earnings for 1940 were $164,553 as against $112,059 for 1939.

Hammermill Paper Company—Net earnings for 1940 were $503,972 as against $463,405 for 1939.

Hinde and Dauch Paper Company—Net earnings for the first quarter of 1941 were $265,747 as against $208,223 for the same period of 1940.

Kimberly-Clark Corporation — Net earnings for the first quarter of 1941 were $516,105, and for the year ending March 31, $2,143,892.

Mead Corporation—Net earnings for the twelve weeks to March 22 were $362,037 as against $357,511 for the same period of 1940.

Missisquoi Corporation—Net earnings for 1940 were $26,874 as against $23,065 in 1939.

Oxford Paper Company—Net earnings for the first quarter were $212,101 as against $136,249 for the same period of 1940.

Puget Sound Pulp and Timber Company—Net earnings for the March quarter were $318,834 as against $180,309 in 1940.

Rayonier, Inc.—The first dividend since 1938 has been declared on the common stock, being 25 cents per common share of record May 24.

Robert Gair Company—Net earnings for the first quarter of 1941 were $175,322.

Scott Paper Company—Net earnings for the period from January 1 to April 5 were $422,306 as compared with $379,239 for the same period in 1940.

Soundview Pulp Company—Net earnings for the March quarter were $489,417 as against $537,036 for the same quarter of 1940.

Southern Advance Bag and Paper Company—Net earnings for 1940 were $768,390 as compared with $72,526 in 1939.

Gaylord Corporation—Net earnings for 1940 were $768,390 as compared with $72,526 in 1939.

Sutherland Paper Company—Net earnings for the year ending March 31 were $761,249 as compared with $808,678 for the preceding year. The drop in earnings was due to lower earnings in the first quarter of 1941.

Union Bag and Paper Corp.—Net profits for the first quarter of 1941 were $560,599 as against $516,931 for the same quarter of 1940. Earnings for the year ending March 31 were $2,170,509 as against $1,328,973 for the preceding year.

U. S. Gypsum Corporation—Net earnings for the March quarter were $1,341,773 as compared with $1,061,921 for the same quarter of 1940.

New York Stock Exchange—Stocks

	Closing Bid	
	May 24	April 25
A. P. W. Paper Co.	*1–1¼	*1⅛–1¾
Celotex	8⅞	9
Same Preferred	68	66¾
Certain-teed	2⅞	3⅛
Same Preferred	24⅞	23¼
Champion P. & F. Co.	18¼	17½
Same Preferred	103½	104½
Container Corp.	13⅝	13¼
Cont-Diamond	7¾	7¾
Crown Zellerbach	11⅞	11⅜
Same Preferred	86	83
Dixie Vortex	*7⅛–8¼	7¾
Same "A"	34½	35
Robert Gair	1⅜	1⅜
Same Preferred	8⅝	8⅛
Gaylord Container	11	*10¾–11
Same Preferred	*52½–56	*51½–54½
Internat'nal P.&P. Co.	13⅞	13⅜
Same Preferred	67⅞	64
MacAndrews & Forbes	25½	25½
Mead Corp.	8	7⅝
Same Preferred	*72½–75	*73–80
Paraffine Co.	27	27
Same Preferred	*101–102¾	*101–102⅜
Rayonnier	12	11¾
Same Preferred	24⅜	25½
Scott Paper	34¼	37¾
Same Pfd. 4½%—	113	112
Same Pfd. 4%—	109	109
Sutherland Paper	18¾	19⅜
Union Bag & Paper	10½	10⅛
U. S. Gypsum	58½	57¾
Same Preferred	175	171

New York Stock Exchange—Bonds

Abitibi 5%	51	45½
Celotex 4½%	95½	94¼
Certain-teed 5½%—	84½	85
Champion P.&F. Co.	106½	104
Inter. P.&P. Co. 5%—	104	103½
Same 6%	103¾	103½

New York Curb Exchange—Stocks

Am. Boxboard	4¼	4¼
Brown Co. Pfd.	14¼	*13–16
Great Northern	39	39
Hummel Ross	5¼	5⅜
Nat. Container	11⅛	11⅛
St. Regis	1¾	1⅞
Taggart	2½	2⅜
United Wall Paper	1⅛	1

*Closing Bid and Asked Prices.

DU PONT BRILLIANT CROCEIN FL

● This product has served the paper industry for many years and is recognized for its outstanding qualities. It possesses several characteristics which make it especially valuable:—

- ▶ **It has greater affinity for paper than most other acid colors and gives fairly clear backwaters even in deep shades.**
- ▶ **It is the fastest-to-light soluble aniline red used on paper.**
- ▶ **When used in high concentrations it causes practically no foam.**
- ▶ **It produces a minimum of two-sidedness—in pink bonds the top side is hardly distinguishable from the wire side of the sheet.**
- ▶ **It possesses good solubility.**

Du Pont Brilliant Crocein FL is recommended for the production of light pink to deep scarlet shades on bond, cover, wrapping and other papers where non-two-sidedness and fastness-to-light are desired.

DU PONT DYESTUFFS

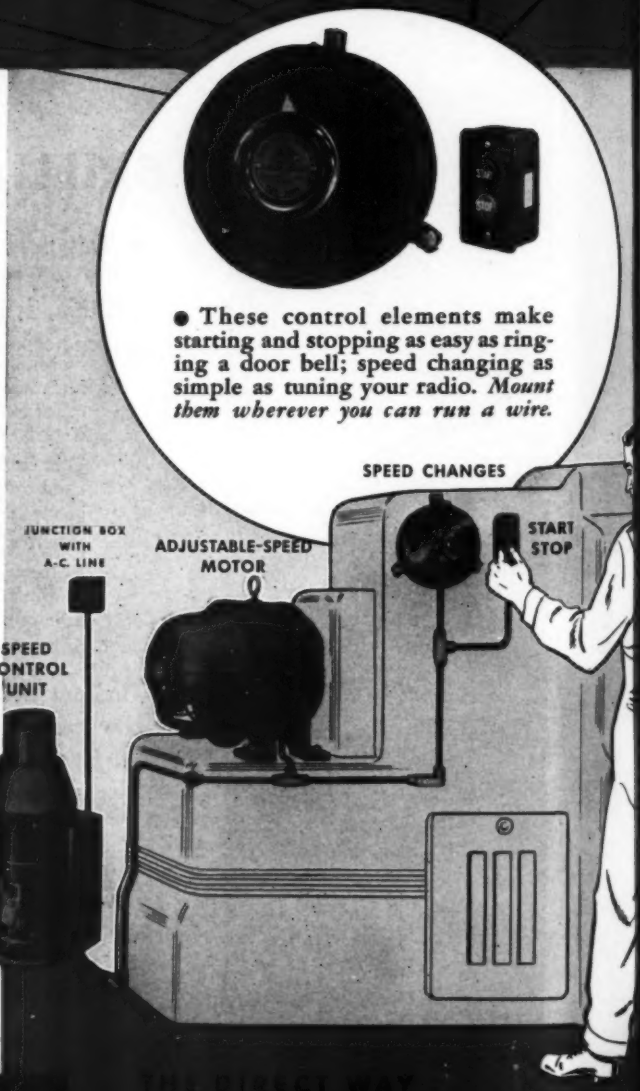
REG. U.S. PAT. OFF.

E. I. DU PONT DE NEMOURS & COMPANY (INC.)
Organic Chemicals Dept., Dyestuffs Div., Wilmington, Delaware

Speed Control Convenience
WITHOUT LIMITATIONS

RELIANCE V*S DRIVE

AN ALL-ELECTRIC ADJUSTABLE-SPEED DRIVE
FOR A-C. CIRCUITS
Speed Ranges up to 16 to 1—Sizes 1 to 30 hp.



● These control elements make starting and stopping as easy as ringing a door bell; speed changing as simple as tuning your radio. *Mount them wherever you can run a wire.*

PICK THE SPOT where speed changing will be done most handily and *when needed.* You can put the speed changer for the Reliance V*S Drive right there, and the *start-stop* station alongside. There are no limitations whether machines are long or short, high or low, wide or narrow. Speed changer and *start-stop* station can be at any distance from the motor or speed-control unit. Put them any place that you can run a wire.

PRODUCTION AIDS

Other features which help boost production are: quick stopping, reversing, safe speeds for threading and inching, ample starting torque with controlled acceleration, and speed setting. *Get Bulletin 310 for details.*

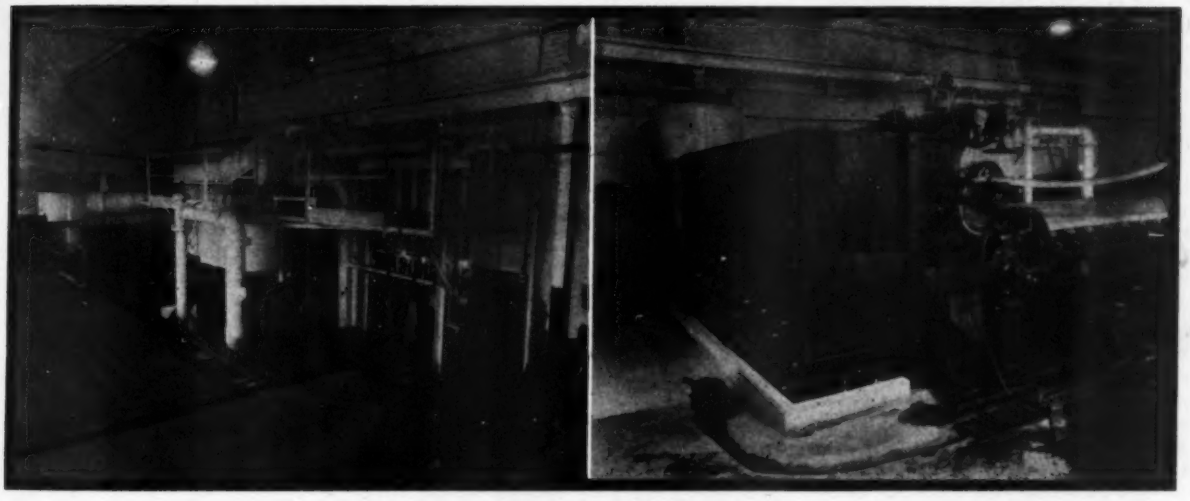
RELIANCE ELECTRIC & ENGINEERING COMPANY
1088 Ivanhoe Road • • • Cleveland, Ohio

BIRMINGHAM • BOSTON • BUFFALO • CHICAGO • CINCINNATI • DETROIT • GREENVILLE (S.C.) HOUSTON (TEX.) • LOS ANGELES • MINNEAPOLIS • NEW YORK • PHILADELPHIA • PITTSBURGH PORTLAND (ORE.) • ST. LOUIS • SAN FRANCISCO • SYRACUSE (N.Y.) AND OTHER PRINCIPAL CITIES

RELIANCE A-C D-C MOTORS

Marathon Paper Mills Co., Rothschild, Wis., Remodels Fourdrinier-Yankee Paper Machine

Left—Showing fourdrinier part, press section, and pre-dryer arrangement. Right—Reel, calender, and Yankee dryers.



Left—Vortrap installation. Right—Bertrams head box.

STATE OF MICHIGAN OFFERS AID FOR KALAMAZOO VOCATIONAL TRAINING

Plans for the proposed vocational training course in Kalamazoo, Michigan, for persons employed in the paper industry were given a further boost by the assurance that the State would shoulder part of the maintenance costs. The initiative in advocating the training is being taken by the Kalamazoo Valley section of the Technical Association of the Pulp and Paper Industry.

Several Kalamazoo men, including TAPPI officials, conferred with representatives of the State Board of Vocational Education in Lansing, May 16. The State Board agreed to assume a substantial part of the expense, if the project is carried out.

Those from Kalamazoo attending the Lansing conference were: W. K. Kidder, Bryant Paper Company, chairman of the valley section of TAPPI; Fred L. Chappell, Sutherland Paper Company, vice chairman; Paul de Guehrey, Michigan Paper Company, member of the executive committee; Archie P. Nevine, industrial co-ordinator at Central high school, and Secretary Earl S. Weber of the Kalamazoo Chamber of Commerce. W. L. Cassidy, instructor of a similar project in Port Huron, Michigan, also was present. Representing the State Board of Vocational Education were F. W. Dalton and George Dean of the trades and industrial division.

Whether the project is carried out now depends upon the employees of the Kalamazoo mills, according to Mr. Kidder. There must be a definite interest on the part of the workers. Enrollment will be voluntary.

As outlined at the Lansing conference, the training would be a two-year course, divided into six divisions of about 10 weeks each, or 30 weeks per year. Employees would attend two one-hour classes weekly. Each subject would be offered at two different hours, to accommodate workers of different shifts.

The course of study would be designed to fit the needs of Kalamazoo workers, and all phases of papermaking would be included. The training would be supervised by the Kalamazoo board of education. One or more full-

time instructors would be hired, depending upon enrollment. It is anticipated that the enrollment in Kalamazoo would be about four hundred.

Tentative plans call for the course to be open at first to employees of Kalamazoo mills, and then expanded to include those of Vicksburg, Plainwell and Otsego concerns. The course would include lectures, outside readings, and reports.

Financing, besides the state's share, likely would be effected by the Kalamazoo board of education and the paper mills. Probable starting for the project would be next October or November. The Kalamazoo Valley TAPPI section will serve in an advisory capacity to aid the staff.

◆

STANDARDIZATION FOR BOXBOARD IS UNCHANGED

The Division of Simplified Practice of the National Bureau of Standards, Department of Commerce, has announced that the Simplified Practice Recommendation R44-36 on "Box Board Thicknesses" has been reaffirmed without change by the Standing Committee of the industry.

This recommendation was first published in 1925 and was revised in 1936. It is of direct interest to manufacturers and users of box board because of the useful information it contains relative to the thickness, finish, weights, etc., of various kinds of board, including non-bending, solid news and solid wood pulp, pasted chip, pasted solid news, patent coated and solid manila, patent coated two sides, and double manila wood pulp filled board. Supplementary information includes definitions and the method of determining the weight of odd-sized sheets of box board.

Copies of R44-36 may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C.

◆

RECLASSIFICATION ON NEWSPRINT BY CAN. GOVERNMENT

The newsprint industry of Ottawa, Ontario, as a result of petitioning of the government by the entire industry, has been reclassified under the Excess Profits Tax. It is now classified as a "depressed industry," which means that the manufacturers will be permitted a "standard profit" of 5 per cent minimum to a maximum of 10 per cent on the productive capital.

Indicative of the savings that this rule will bring to companies is the 12 per cent tax on $1,000,000 that the St. Lawrence Paper Company paid in 1940, and a 22 per cent tax for this year. The Great Lakes Paper Company will be absolved from tax on $320,000, and the Donnaconna Company will have an additional exemption of $140,000. The $850,000 fund set aside for tax requirements by the British Columbia Pulp and Paper Company can also be substantially reduced.

◆

WISCONSIN VOTES FUNDS TO FIGHT BLISTER RUST

Approval for an additional $18,430 WPA funds has been received for Wisconsin blister rust control. Approximately 180 workers are being employed through June, their work supervised by five department of agriculture aids.

During April, 1,722 acres of white pine were mapped in Ashland, Barron, Forest, Langlade, Oneida, and Vernon counties; 4,949 gardens in Fond du Lac, Manitowoc, and Vernon counties were examined for cultivated black currant plants. One hundred ninety-two acres of white pine in Barron, Langlade, and Waushara counties were protected by ribes eradication during the month, while 46 black currant plants were found and removed from 25 different locations.

BRIEFS

▶▶▶ A BALLOON ASCENSION CONTEST will high-light the activities of the annual Kimberly-Clark Corporation picnic to be held July 27 at Lakeview Park in Neenah, Wisconsin. Two thousand balloons are sent up, upon which the owners attach cards with their name and address and a request that the finder return the balloon. A prize is awarded to the person whose balloon is returned from the farthest distance. The all-day affair also includes ball games, music by the employees' band, a carnival, races for the children, speeches by officials, and a dance.

◆

▶▶▶ REPORTS OF WAGE INCREASES from various portions of the country show a series of increases granted by different companies. Among the wage increases were the following: International Paper Company, 5 cents per hour in the book, bond, and groundwood divisions; Sorg Paper Company, 6 cents per hour for male and 4 cents for female labor; Parker Young Company, 10 per cent; St. Croix Paper Company, 3 cents with an additional 2 cents before November; Hollingsworth & Whitney, 5 cents; Great Northern Paper Company, 5 cents; Hoberg Paper Mills, 3 cents; Nekoosa-Edwards Paper Company, 3 cents; Hammermill Paper Company, 8 cents; Consolidated Paper Company, 10 cents; River Raisin Paper Company, 5 cents; Kieffer Paper Mills, 7½ cents to 12½ cents, depending on the previous basic rate.

◆

▶▶▶ THE MICHIGAN PAPER COMPANY, Plainwell, Michigan, announces that it is moving the Coating Plant from Kalamazoo, Michigan, to Plainwell; and it is expected that the first coating machine will begin operations in the very near future.

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▶▶▶ THE FEDERAL TRADE COMMISSION has issued a complaint charging the Tag Manufacturers' Institute and 31 member companies with restricting competition through various devices, principally through dissemination of information about all price offerings.

◆

▶▶▶ ALL CHEMICAL WOOD PULP is now subject to export license control. While it is possible to secure permits for exports of such pulp, the order placing pulp under export control makes it possible for the Government to restrict shipments if the volume of export business threatens to seriously affect domestic requirements.

◆

▶▶▶ A RECENT ANNOUNCEMENT from Rayonier Incorporated states that its current prices for paper, specialty, and dissolving pulps for South America, Mexico, and the domestic market will remain unchanged for the third quarter of this year, from July 1 to September 30, 1941.

◆

▶▶▶ ALL OF THE MANUFACTURING EQUIPMENT of the Cannard Manufacturing Company, Green Bay, Wisconsin, has been moved to Little Chute, where a modern new plant has been established. There will be approximately 25 employees engaged in the manufacturing of paper converting machines.

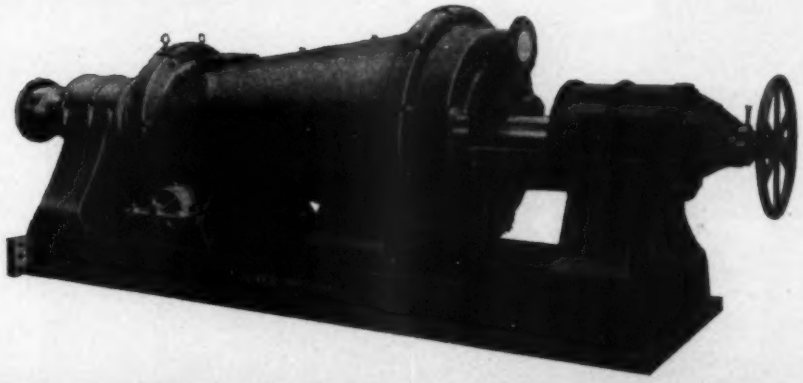
◆

▶▶▶ AN ANNOUNCEMENT by Attorney General Jackson on anti-trust prosecutions is arousing much comment. He announced that business interests aiding the Federal Government in national defense effort will not be prosecuted under the anti-trust laws for any action taken toward price sta-

Installation View Jones Modern Majestic Jordans

JONES JORDANS

Year after year, Jones engineers studied the faults of conventional Jordans, saw the weaknesses, and corrected them, one by one. And today, Jones Modern Jordans embody new design and features which eliminate the operating difficulties heretofore encountered by most Jordan users. May we tell you about these features?



Jones

E.D. JONES & SONS COMPANY-PITTSFIELD, MASS.

Builders of Quality Machinery for Paper Mills

bilization in accordance with the Government's efforts to prevent runaway markets. Such immunity is granted in those cases where the corporations are complying with requests from the Office of Production Management, and the Office of Price Administration and Civilian Supply.

◆

▶▶▶ THE SORG PAPER COMPANY in Middletown, Ohio, announces a contest among printing houses, during the coming year for books, booklets, broadsides, letterheads, menus, post cards, tags, maps, business forms, or any other type or kind of material printed or lithographed on any Sorg paper. Awards will be made semi-annually, covering six month periods ending respectively, July 1, 1941, and January 1, 1942. The last day for receiving entries in the first period of the contest is July 1, 1941.

◆

▶▶▶ FOUR OF MEXICO'S leading publishers visited Canada last month and made a tour of inspection of paper mills in the St. Maurice Valley and other centers from which they receive their newsprint.

◆

▶▶▶ MATHEW J. BURNS, former president of the American Federation of Labor paper makers union has joined the labor division of the Office of Production Management.

PAPER MILL MACHINERY
Straight, Harper and Edwards Fourdriniers—For book, bond or fine tissues.
Cylinder and Wet Machines. Jordans — Pumps — Calenders "Rainstorm Shower Pipes".
Below: THREE PLUNGER STUFF PUMP
For the Finishing Room
UNDERCUT TRIMMER
Electric Eye Web Edge Control — Slitters—Reels—Rotary Cutters.
Above: Rotary SPOT CUTTER
FOR BAG PLANTS
Flat, square and satchell bottom bag machines—single and multiwall pasted valve bag machines — tuber and bottomer type bag conveyors.
Below: HEAVY DUTY MULTIWALL TUBER WITH COMPLETE AUTO COMPENSATOR FOR PREPRINTED ROLLS.
The SMITH & WINCHESTER Manufacturing Company
SOUTH WINDHAM CONNECTICUT
6

▶▶▶ WARTIME RESTRICTIONS on paper supplies in Australia were announced by officials on May 22. Consumption is being controlled on letterheads, scribbling tablets, menus, paper plates, movie programs, and toilet rolls. It was also announced that tinfoil, normally used in the packing of candies, cigarettes, and tobacco would also be prohibited from use.

◆

▶▶▶ NEWSPRINT SPED through a G-E driven paper machine at Southland Paper Mills, Inc., Lufkin, Texas, for 49 hours without a wet end break or a snapoff at the calender stack. General Electric turbines in this plant were equipped with three-arm governors, capable of holding speeds within extremely narrow limits under swings of the load. To prevent even this small variation from interfering with the successful operation of the machine, voltage and speed regulators were carefully co-ordinated in the drive.

◆

▶▶▶ A 14 PER CENT INCREASE in the number of employees at the Paraffine Companies, Inc., over last year was recently announced by officials. The explanation offered for the increase was the big rush for defense orders.

◆

▶▶▶ SEVERAL BILLS dealing with stream pollution have been introduced in Congress during the present session, but it is thought unlikely that they will result in any immediate action.

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▶▶▶ A RECENT ANNOUNCEMENT issued by the West Virginia Pulp and Paper Company, New York, states that after May 23 all communications now addressed to the New York Laboratories of this company should be addressed to the Development Department of the West Virginia Pulp and Paper Company in Charleston, South Carolina.

◆

▶▶▶ THE PRICE OF KRAFT LINER board will be advanced to $60 per ton on July 1, according to a report from the major producers. This is an increase of $5 per ton.

◆

▶▶▶ CURRENT DOMESTIC NEWSPRINT PRICES will be extended throughout the third quarter of this year at the present level, it was recently announced by R. J. Cullen, president of the International Paper Company, New York. It was added, that the factor of increasing costs of manufacturing and transportation is becoming steadily more of a problem.

HERE'S PROOF

. . . That *NO OTHER* Turbine Oil can match the performance of the sensational *NEW* SHELL TURBO OIL

The 4 steel test strips shown above prove that Shell Turbo Oil positively prevents rusting. All 4 strips were immersed for 48 hours at 167° F. in 4 well-known turbine oils, maintained in intimate contact with 10% of distilled water and continuously agitated at 1200 R.P.M. Strip at extreme left, immersed in Shell Turbo Oil under these severe test conditions, shows no rust. All other strips were badly rusted.

WHAT are the 3 vital requirements of modern turbine lubrication?

RUST PREVENTION

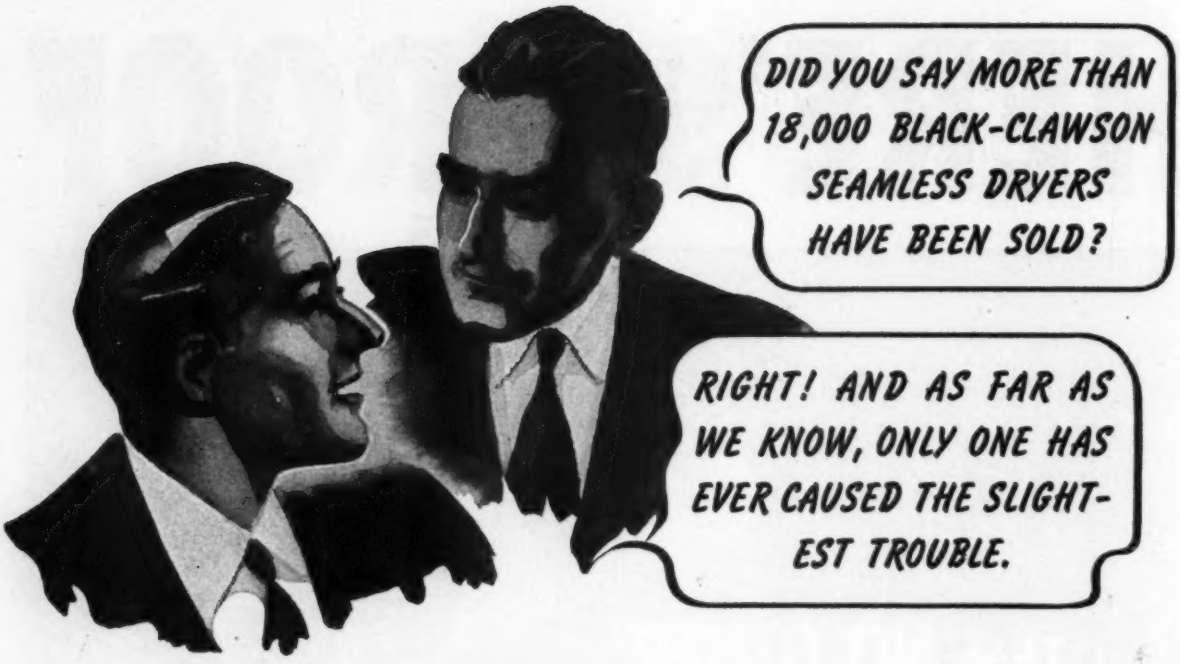
SUPERIOR OXIDATION STABILITY

NO FOAMING

The new Shell Turbo Oil is the *first* and *only* lubricant to meet all 3 of these major requirements. No wonder it's creating a sensation!

GET THE DETAILS TODAY!

SHELL TURBO OIL


DID YOU SAY MORE THAN 18,000 BLACK-CLAWSON SEAMLESS DRYERS HAVE BEEN SOLD?
RIGHT! AND AS FAR AS WE KNOW, ONLY ONE HAS EVER CAUSED THE SLIGHTEST TROUBLE.

BLACK-CLAWSON SEAMLESS DRYERS HAVE MADE AN AMAZING SALES RECORD... *and here are the reasons*

- We will give the facts to you short and brief. B-C dryers stay in balance longer. 77 dryers, 36" x 78", in service for 20 years, were recently checked for true. None was out more than .041".
- B-C dryers, being unbored, retain glass-like, rust-resisting interior film. Greater cleanliness, greater heat transfer results.
- B-C dryers withstand higher pressures. A 40 year old dryer was recently tested, cracked only after 550 lbs. p.s.i., even then the heads did not burst.
- B-C dryers have no large projecting flange at junction of head and shell. Such flange can't be properly heated, often causes streaks at edge of sheet.
- There you have it . . . reason why 18,000 have been sold. If you have any questions, send them in.

The Black-Clawson Company,
Hamilton, Ohio

Shartle Division, Middletown, Ohio
Dilts Division, Fulton, N. Y.

BLACK-CLAWSON
SEAMLESS DRYER

Foxboro Finds The Way

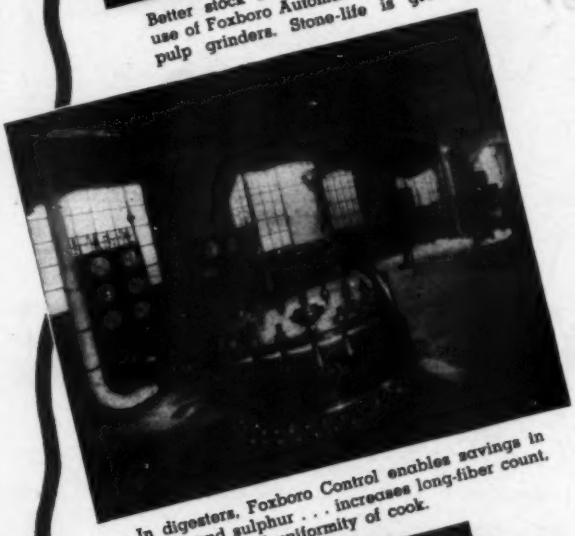
TO BETTER QUALITY AND COSTS!

When you are considering installation of additional instruments, don't make your final decision until you have investigated Foxboro's original instrument systems for many important paper-making operations.

Foxboro Instrumentation for pulp and paper mills is engineered by men who learned paper-making from practical mill experience. They know methods and desired results . . . develop instrumentation specifically to make processes operate more smoothly and more productively. Foxboro Instrumentation is creative instrumentation that *finds the better way!*

Illustrated are just four of many original Foxboro Systems now improving pulp and paper production. Write for detailed information on Foxboro Instrumentation for these or other processes. **The Foxboro Company, 158 Neponset Ave., Foxboro, Mass., U. S. A.** Branches in principal cities of United States and Canada.

Better stock is produced at lower cost through use of Foxboro Automatic Temperature Control on pulp grinders. Stone-life is greatly increased.



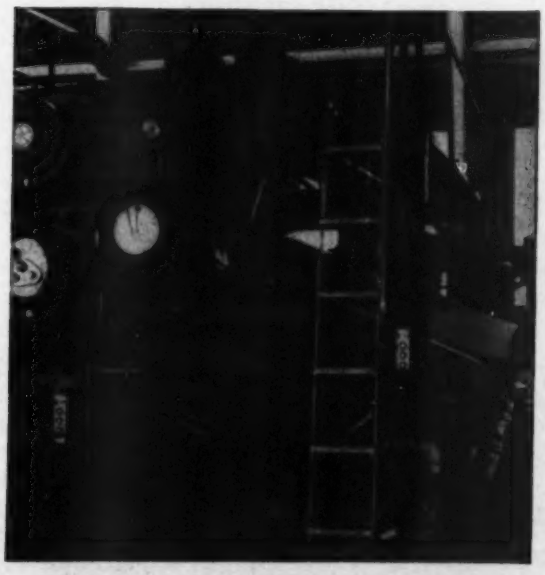
In digesters, Foxboro Control enables savings in steam and sulphur . . . increases long-fiber count, and speed and uniformity of cook.

Foxboro Verigraph Controller is the only equipment that continuously measures moisture of moving paper and automatically regulates steam to dryers. Feels changes as small as 1/10 of 1%!

FOXBORO

REG. U. S. PAT. OFF.

Creative Instrumentation



Foxboro Pneumatic Loading for press rolls and other roll-equipment maintains exact, calibrated pressure on each end of roll independently.

EXPERIMENT *versus* EXPERIENCE

Experiment is the testing process to discover the truth. Experience is the knowledge resulting from experiment. American paper manufacturers for eighty years have experimented with many kinds of wet-end felts to discover which is the most efficient and the most economical. They know by experience that Hamilton Felts most completely meet the conditions of actual mill practice.

If you are now using Hamilton Felts on your paper machines you know that they remove more water faster, with less down time and less broke. If you are still experimenting equip one of your machines with a Hamilton Felt and keep accurate record of its performance. Your own experience will suggest the wisdom of making Hamilton Felts *standard* equipment on all machines.

• *From the thinnest tissue to the heaviest board there is a Hamilton Felt that will do your work better, faster and at lower cost.* •

SHULER & BENNINGHOFEN, HAMILTON, OHIO

• **Miami Woolen Mills** •

Hamilton Felts

• **Established 1858** •

There's more to POWELL QUALITY than meets the BUYER'S EYE!

DID YOU EVER CONSIDER THE FINAL STEPS, IN THE MANUFACTURE OF A LARGE VALVE? It's a Major Operation . . . and it's treated as one at Powell!

A large steel or alloy valve coming from the foundry represents countless hours of research, design and casting technique . . . but it still lacks the final machining and testing that will turn it into an efficient product that will be well worth its purchase price. Undoubtedly, then, these two final operations are of vital importance . . . it's a major part of any valve's manufacture, and Powell, accordingly, stresses these two phases.

Take, for instance, the machine shop. Modern tools in the hands of skilled operators assure accurate fitting of parts . . . constant inspection and accurate gauging of parts insures proper fit in assembly . . . guarantees a pressure tight valve. Then, testing. Here's the proof of the pudding. Each valve is tested under pressures far exceeding its rated capacity. Each moving part is seen to work exactly as it should. Each completely assembled valve is again rechecked and inspected . . . then, and only then, is it approved for shipment . . . guaranteed for use on large lines that can't be burdened with inefficient valves.

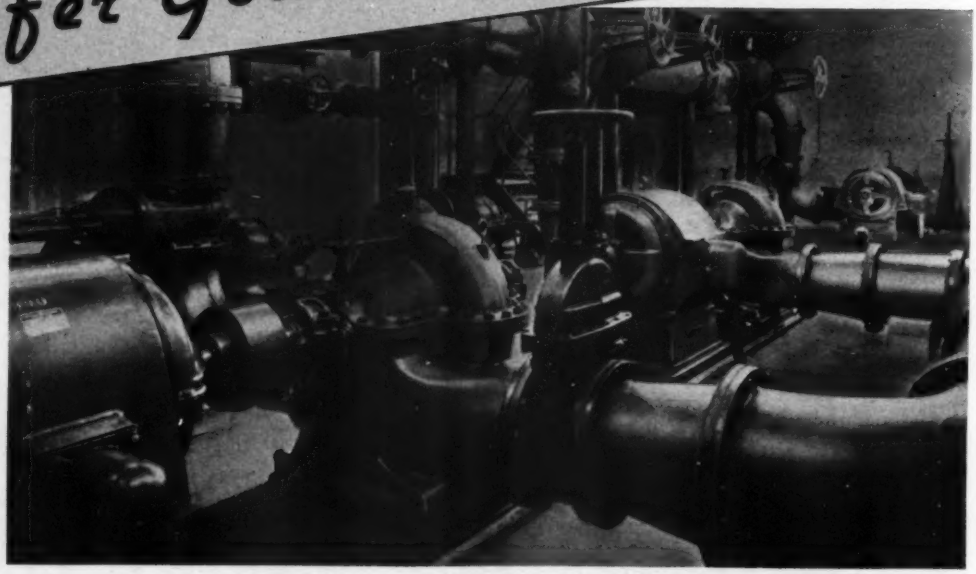
So, in summing up the important operations that go into the building of a large valve, it can be seen that machining and testing stand near the top . . . that they are very necessary in assuring "quality, through and through"—a phrase truly applicable to every Powell product.

You Need More Than a Photograph of the Finished Product to See ALL the Qualities that Make Powell Valves Uniquely Able to Better Serve the Mill Owner

POWELL VALVES

THE WM. POWELL COMPANY • CINCINNATI, OHIO

WHY MODERN PAPER MILLS *Prefer Goulds Pumps*



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EDITORIAL

Paper Operation Satisfactory

▶▶▶ DOWN IN WASHINGTON, D. C., they have been having some animated discussions as to whether prices on commodities would rise and whether or not ceilings should be placed upon the prices of all goods.

The discussions seem to have arrived at no definite conclusions, and as far as we can see, the reason is that the administration authorities appear loathe to admit that wage increases were one of the prime factors which caused the prices on commodities to advance.

One of the outstanding leaders in the price control division stated "that wages should be compared with profits, not prices." We don't know what is meant by that statement. If it is used as a basis for eliminating wages as factors in prices, it is as futile as trying to eliminate rain as a material factor in the growth of grass.

Prices will not remain stable unless all the factors which enter into price making remain stable. When wages rise, every raw material, all transportation, all commodity prices into which wages enter as a factor, will rise. There is nothing wrong nor harmful in the proper advance in wages and prices. They should advance concurrently. The only thing to be avoided is an out-of-proportion advance of either wages or prices to their proper ratio.

Again, we say, the paper industry has given a fine exhibition of sensible and sane price control. As evidence of that fact, we cite some figures of the kraft paper division, which is the greatest tonnage producer of all divisions, showing that for the first five months of 1941, the advance in paper prices, over the first five months of 1940, was $7.50 per ton, or 37½c per hundred pounds, or three-eighths of a cent per pound. That covers a period of seventeen months and is the most conservative advance ever made in the history of the industry, especially in view of the unprecedented demand of tonnage. The demand for paper and paper products is seemingly insatiable. On the basis of the average Federal Reserve Bank Production Index, which for the first five months stands at 140, the consumption of paper and paper products is going on in this country at the rate of 19,000,000 tons this year as against 16,600,000 for 1940.

We are able to account for a capacity operation of about 18,500,000 tons, so, on the basis of the present setup, it is perfectly apparent that the demand for paper is about equal to the capacity production and about one year ahead of the volume anticipated.

The paper industry is experiencing no distress in complying with every actual need for tonnage for civilian as well as governmental requirements, and it is certain at this writing that the same good sense which has guided and dominated the production and price operations of the industry will continue to obtain.

◆

Figures to Figure

▶▶▶ SOME VERY INTERESTING STATISTICS for pulp and paper mill executives and operatives have appeared recently in several issues of *Industrial Reference Service*, one of the new publications of the U. S. Department of Commerce, Bureau of Foreign and Domestic Commerce. These issues, designated individually as Business Series No. 1, 4, and 5, cover respectively a summary of the nations' horsepower, industrial coal consumption, and expenditures for industrial plant and equipment.

The combined aggregate horsepower of prime movers in paper and paperboard mills and in pulp mills of the United States in 1939, according to the figures, totaled 2,745,059. This prime mover capacity was made up of 1511 steam engines with a total horsepower of 396,515; 1411 steam turbines with a total horsepower of 1,593,097; 17 Diesel and semi-Diesel engines with a total horsepower of 3,209; 22 other internal combustion engines with a total horsepower of 4,078; 1146 hydro-turbines and waterwheels with an aggregate capacity of 748,160 horsepower; generators with a total kilowatt rating of 1,517,966, and electric motors (39,592 driven by purchased energy, 8,931 driven by plant energy) with an aggregate horsepower of 3,213,637. The kilowatt hours of electric energy generated by the mills was 6,297,943,284. Of this amount, 210,499,793 kilowatt hours were sold. Purchased electric energy, on the other hand, amounted to 2,972,958,641 kilowatt hours.

The statistics also reveal that the combined fuel consumption of the paper and paperboard mills and the pulp mills of the United States for 1939 was as follows:

Coal (anthracite)	993,635 tons
Coal (bituminous)	8,723,849 tons
Coke	22,544 tons
Fuel oils	6,212,799 bbl. 42 gal.
Gas (natural)	28,913,336 M cu. ft.
Gas (manufactured)	1,841 M cu. ft.
Gas (mixed)	121,642 M cu. ft.

The figures likewise show that in 1939 the paper and allied products industries of this country expended $67,478,936 for industrial plant and equipment. This sum, the fourth largest outlay in the complete grouping of industries—all industries being classified into 20 major groups, was exceeded only by the food industries, textile, and other fiber manufactures and automobile and automobile equipment.

Of the $67,478,936 expenditure, paper and paperboard mills accounted for $37,501,951; pulp mills for $9,310,064; the remainder being made up by the allied products industries. When itemized, the expenditure by paper and paperboard mills included $9,758,757 for new construction or major alterations of buildings and other fixed plant structures, $26,112,978 for new machinery and operating equipment, $1,136,091 for plant equipment acquired in a used condition from other owners and expenditures for land, and $494,125 for unclassified items. Pulp mill expenditures for the same purposes, arranged in the same orders, were as follows: $2,159,408, $6,104,623, $257,130, and $788,903.

CURRENT THOUGHT . . . . . .

Priorities . . . . . WILLIAM SIBLEY

▸▸▸ DURING THE LAST WEEK OF MAY, I had the privilege of hearing an address given by Philip D. Reed, formerly chairman of the board of General Electric Company, but now senior consultant in the Priorities Division of the Office of Production Management. He was addressing 2400 of the Purchasing Agents of the nation, assembled for their 26th annual convention. Mr. Reed spoke extemporaneously and so I have no way of making direct quotations. And that is your loss because his was a talk I wish might have been heard by every industrialist in the country.

One of the first insistent assurances made by Mr. Reed was his firm belief that this nation would be at war with some form of totalitarianism, not for months to come, but for years and years. He admitted that the economic war would be severe for the next five to seven years, but that for at least the next five years our prime emphasis will be on military production. This may or may not coincide with your personal ideas on the matter, but considering whence the statement came the lugubrious fact demands serious consideration. And in Mr. Reed's viewpoint, the sooner nondefense industries face the facts, the better and more easily the necessary adjustments for a shift of materials and men into arms production may be made.

Under Edward R. Stettinius, Jr., and Philip D. Reed, a priorities organization is taking shape. As you know, it is styled "OPM"—which, in reality means Office of Production Management, but to some it stands for either "Other People's Money" or "O Promise Me", depending upon individual viewpoint and need. Even though this office has been in existence only a short time, already it has listed 265 items or classes of items as being those needed by the armed services. This list of 265 items now on the priorities critical list undoubtedly will be lengthened materially as time goes on, but even now it extends through the alphabet from Acetone to Zinc.

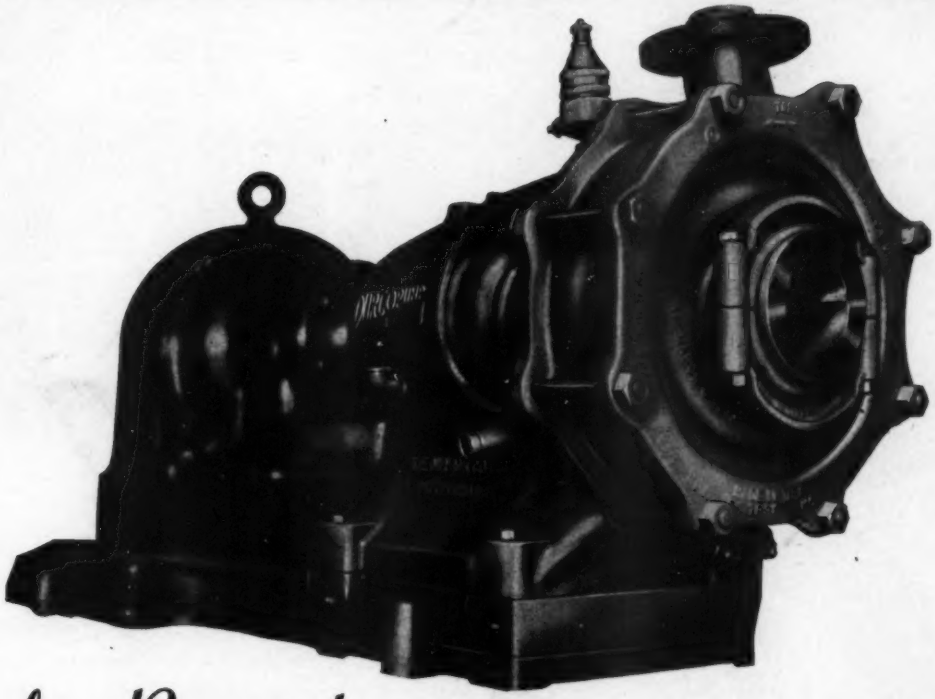
One of the ways to keep this list from lengthening unduly, as well as one of the important ways to aid national defense, is for each and every one of us to forego being human and individually selfish and become collectively considerate. That means, in the mind of Mr. Reed, keeping inventory, of whatever kind, down to the minimum of current needs. Without benefit of manuscript of his talk, I shall try to guess at his phraseology and tell you, in substance, what he told the purchasing agents assembled. He said:

You are purchasing agents. You are also human. Your job is not alone to buy needed material at the price you want to pay from a source you can rely upon to keep delivery dates. Your job also comprehends anticipation of rising prices so that you can get ahead of them with ample stocks. It also comprehends production needs so that you can pile up inventories which will give your plant needed material at the time that material is needed. . . . May I say—that is *not* the way to buy today. Because of the present, and future emergency, we may expect shortages of strategic, and even normal, products for a long time. We must have no top-heavy inventories. To stock up on needed material far in advance of current needs is first, unpatriotic. It is unpatriotic because such advance stocking might easily withhold that material from some other manufacturer who needs it far more in the interest of pure defense. Second, it will undoubtedly be unprofitable. You may buy your needed material today at a price which will seemingly save your firm considerable money in the future. But listen—

Back in 1935, the Government said that it was most unpatriotic to buy and hoard gold. That metal was, at that time, put on the Government's "critical" list. By far the majority of the people of the United States turned in their gold coin and currency and bullion. But not all. So, not long after the governmental suggestion that to hoard gold was unpatriotic, there came an edict which made it most unprofitable for anyone to have gold in his possession. . . . Now the analogy is not entirely to my liking nor entirely true to order. But—well, you may take that analogy for what it is worth.

Please believe me—the above is not a direct quotation. I have no manuscript from which to quote. But the substance of Mr. Reed's talk regarding controlled inventories is there—and if we are to win the struggle that has been thrust upon us at the earliest possible, rather than a belated, month we will abide by his combined hope and threat.

Mr. Reed knows that priority control must be as flexible as possible. It must exercise governmental interference as little as possible. He knows that it must keep normal, civilian industry moving so that shocks to employment and community activities will be minimized. But there is nothing in the defense setup that can hold so vital a grip on industry. Priority control carries the power to withhold materials and machines from anyone, at any time,—more especially from those who refuse to co-operate with the Government. Its very name "Priority" means that someone, sometime, is going to be hurt. It means that demands and restrictions will be placed somewhere, which will be outside the boundary of normal business. And that will rankle. But there will be less hurt—greater co-operation for national defense (the one essential today) if Mr. Reed's advice is taken and put into action—in every plant.



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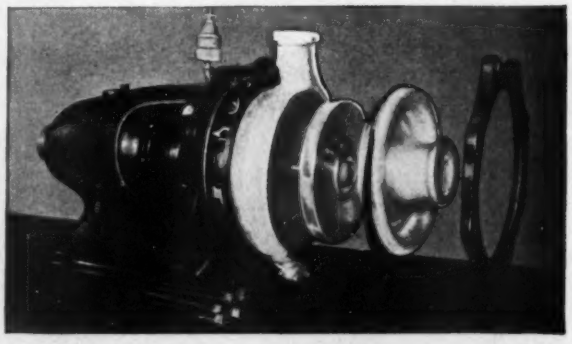

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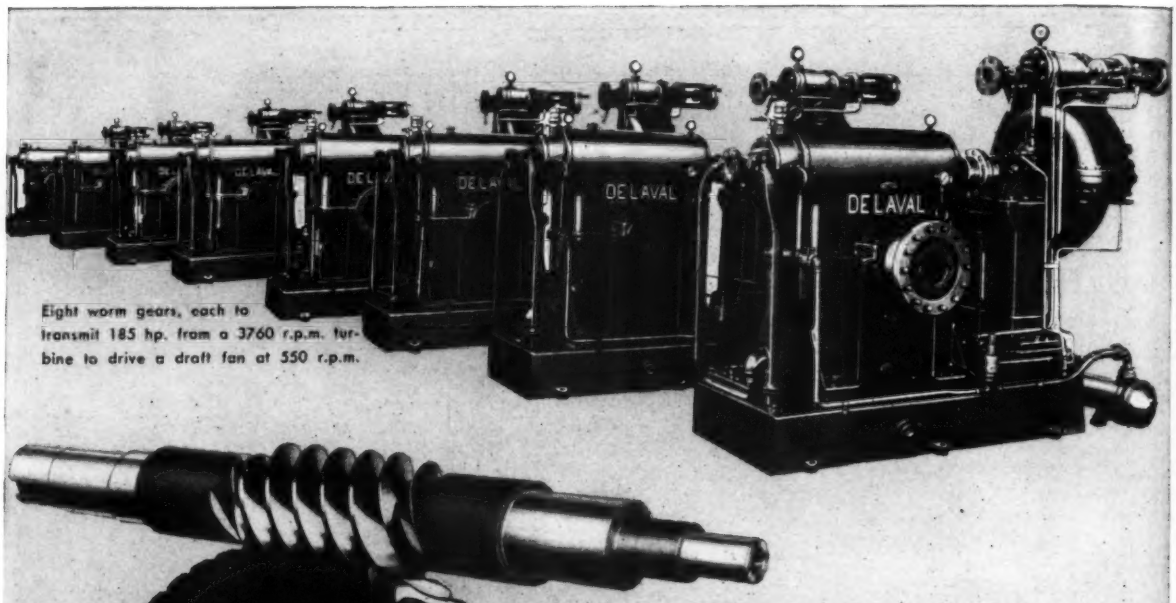

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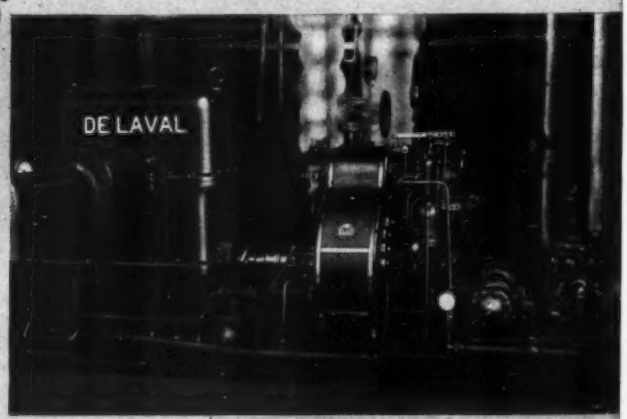

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BAMBOO PULP *by Use of a Hydrotropic Solvent*

HONG LAU, M. S.

ABSTRACT

The study of the manufacture of pulp from bamboo by use of a hydrotropic solvent has developed two important considerations. This process gives a good yield of high-grade pulp satisfactory for the same purposes as sulphite pulps from wood. The amount of chemical required is far less than in the usual wood pulp processes and the liquor may be re-used a number of times. Both of these advantages make the process of particular interest to regions where wood is scarce, especially as such locations are also largely remote from sources of chemicals for ordinary wood pulping methods.

A by-product is bamboo lignin for which numerous uses can be expected apart from its fuel value.

Although only one hydrotropic solvent salt was tested in this study, it is believed that equivalent materials *(13, 19)* would give analogous results and that choice would be governed principally by economic factors.

The hydrotropic properties of some aromatic sulphonate solutions have been studied by Hanslick *(13)*. He defines hydrotropic solutions as "those aqueous salt solutions which effect greater solubility of slightly soluble substances than does pure water of the same temperature" *(13)*. He found that the solubility of organic compounds in these hydrotropic solutions is not due to the formation of chemical compounds between the solute and the sulphonates and that the hydrotropic solutions may be considered as mixed liquid solvent. The solvent properties of such solutions can be changed to non-solvent properties by the addition of water. The solutions can be used repeatedly by evaporation of the excess water.

Pelipetz *(19)* later found that aqueous solutions of xylenesulphonate and cymenesulphonate salts are good solvents for lignin. Maple, poplar, and white pine were extracted with a concentrated solution of sodium cymenesulphonate and the possibility of manufacture of paper pulp by hydrotropic solutions was pointed out.

The industrial use of hydrotropic solutions in the manufacture of cellulosic pulps has been taken up by Professor McKee and, while still under development, has been covered by patent application filed in the United States Patent Office. Sodium xylenesulphonate was chosen for this study as the pulping agent because it can be obtained at low cost.

The fundamental advantages of this process are: (1) production of a higher yield of an excellent bamboo pulp as compared to processes now used commercially; (2) repeated use of the solution and the simple and complete recovery of the chemicals employed; (3) no evil smelling gas or the trouble of disposing of waste liquor; and (4) no other chemicals are needed.

THE PROBLEM

Since bamboo is a potential raw material for cellulose, and its structure and composition are quite different from wood, the problem was to study the possibility of the application of the hydrotropic process to the manufacture of bamboo pulps within the limiting conditions of commercial practice, the various cooking conditions, the properties of the resultant pulps, the recovery of the hydrotropic solution, and some properties of the bamboo lignin.

The potential importance of bamboo as a source of cellulose depends upon its rapid growth and ease of cultivation which are described by Raitt *(24)*, Porterfield *(22)*, and West *(37)*. In general, the forestation can be carried out by seedlings or by the separation of culms and rhizomes. The total time required for the 40-foot high culm to complete its growth, including branches and leaves, was found to be five or six weeks. It will become mature in eighteen to twenty months and is then ready for paper making. The cutting can be continued for some fifty years until the bamboo flowers and the cycle starts over again. However, only about one-fifth of the total stands can be cut each year because the whole clump of bamboos having common rhizomes acts as a single plant. Too much cutting would result in production of weaker and smaller new culms, while proper cutting has the opposite effect of maintaining a strong and prosperous forest. After five years standing crops vary with species and locality from 7 to 30 tons dry weight per acre.

Furthermore, the characteristics of bamboo are such that it has a density about double that of soft wood, is devoid of bark, and can be cut the whole year round. Each stem is uniform in quality as the whole stem is of one season's growth. Bamboo can be transported cheaply by water by floating it in rafts. Thus, bamboo possesses all the desirable features of wood and does not have the disadvantages of cornstalks and straw which militate economically against their use as papermaking materials in competition with wood *(10)*. However, the most important factor in determining the utilization of bamboo for papermaking and cellulose is the discovery of a new process which will, like the adaptation of the sulphite process to spruce, produce a clean, strong, and cheap pulp to meet the demands of the paper and cellulose industries.

Bamboo is found in the West Indies, Trinidad, and the Guianas but is not indigenous to the United States. The Office of Plant Introduction, U. S. Department of Agriculture, *(11)* has introduced 60 species of bamboos into this country and found that in suitable soil they can be grown in all the South Atlantic and Gulf Coast states and also in portions of southern Arkansas, California, and Oregon. Loftin, in New York, *(15)* claimed that cellulose can be produced from bamboo for the manufacture of the best papers, cellophane, and smokeless gunpowder. He believed that the bamboo pulp industry could be developed in this country and suggested that bamboos be imported from the West Indies or that the bamboos in Florida be investigated.

The situation in other countries is quite different. In China bamboo is so common in the middle and the southern regions of the country that it was estimated there are at present 120,-

EDITOR'S NOTE: Complete text of a thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the faculty of pure science of Columbia University, New York City.

000 square miles of bamboo forest and isolated groves *(22)*.

The demand in China for wood lumber for furniture and construction is acute. Under such conditions, it is most important to devise a good process for the manufacture of pulp from bamboo in order to assure an adequate supply of this material for the national paper and cellulose industries.

Two kinds of bamboo were used in this study the *Bambusa tulda* which is probably the best bamboo for papermaking in this country, and the *Phyllostachys bambusoides* which belongs to the same genus most common in China.

Review of Previous Methods

According to Raitt *(24)*, bamboo should be crushed before digestion. This is based on the fact that bamboo is a hard substance containing silica and is wearing to the knife, but it has little resistance along the vertical direction. The results of crushing are an increase of apparent volume to 1.7 times that of the original bamboo, a slight increase in density due to compression, elimination of buoyancy, thus facilitating the penetration of cooking liquor and consequently securing a uniform result. This seems to be a general practice employed by most of the investigators. However, Joiner *(14)*, Director of the Papermaking Society of Indo China, noted that there is no difficulty in producing a first class easy bleaching pulp by using bamboo chips. This would increase the digester capacity and reduce manufacturing cost as compared with crushed bamboo. Other investigators, like Richmond in the Philippine Islands *(26)*, also claimed good results by using chips.

The soda process was considered as the most suitable method for pulping bamboos *(18, 24, 26, 34)*. It may be operated in one or two stages. The two-stage or fraction method was worked out by Raitt. He digested the bamboo first for 2 hours at 115 deg. C. with spent liquor and next with a 5 per cent fresh solution of sodium hydroxide for 1 hour at 158 deg. C., and for two more hours at 140 deg. C. The yield was 42 to 45 per cent unbleached pulp and required 10 per cent of bleaching powder (35 per cent available chlorine) for bleaching. This method is now employed for the manufacture of bamboo pulps in India.

Bamboo pulps are now produced in India, China, Indo China, Trinidad, etc. *(17)* where either the fractional method or the one-stage alkali method is believed to be used.

The ordinary sulphite process was reported to be unsuitable for bamboos *(34, 37)*. Richmond *(26)* obtained a strong brown pulp which could not be bleached. The methods of Jardine and Nelson *(6)* and of Harry Vincent *(35)* were able to produce a bleachable pulp by cooking with a solution of magnesium or sodium bisulphite, but in most of the cooking period an almost neutral condition was maintained.

The Pomilio chlorine-caustic soda process *(21)* has been successful for pulping grass and straw. Although experimental data are lacking it might possibly be applied to bamboo, which is also a grass.

Sala *(31)* has worked out an elaborate method for producing alpha pulp from bamboo. He followed Raitt's fractional sulphate cooking method and, after removing silica by treating with hydrofluoric acid, refined the pulp by heating in a dilute solution of sodium bisulphite at 60 to 120 deg. C. He finally bleached the pulp with hydrogen peroxide. The pulp was reported to have an alpha-cellulose content of 96 to 98 per cent, copper number 0.6 to 1.5, ash 0.3 per cent, and a yield of 35 to 40 per cent on the weight of dry bamboo, but of course at high cost.

The microscopic study of bamboo fibers *(24, 34, 36)* showed that the fibers are similar, in general, to those of grass and straw. The fibers are usually long and slender with thick, but seldom pitted, walls and a small lumen. They are augmented by very wide, pitted, thin-walled fibers, parachyma cells, and vessel segments. The fiber length varies from 0.45 to 4.5 mm. with an average of 2.7 mm. The fiber diameter has an average of 14 microns. Vidal and Aribert *(34)* attributed the strength of bamboo fiber to the thickness of the cell wall, and its felting power to the small ratio of the fiber diameter divided by its length.

Information about the chemical and physical properties of bamboo pulps and papers is not available. Since they are manufactured by the soda and sulphate processes they can be expected to possess properties and uses similar to those of the corresponding wood pulps. Bamboo pulp was described as strong, soft, opaque, bulky, and with good felting properties. Raitt *(25)* stated that it is better than esparto pulps, can be beaten to a high degree of hydration, sizes very hard, and has been approved in England as a body paper for coatings. Its best purpose is for high class printing papers, especially paper for art and color work.

Advantages of the New Process

From the literature it appears that the alkali process is the only method now available for pulping bamboos. Soda pulp, although it has good printing properties, is in general inferior in strength and alpha-cellulose content due to the drastic action of the alkali employed. While sulphite pulp from wood has excellent properties, the sulphite process is not suitable for bamboo pulping.

The characteristics of the bamboo pulp produced by the new process employing a hydrotropic solvent such as a sufficiently concentrated solution of sodium xylenesulphonate, are better than those of ordinary sulphite wood pulps. It can be confidently expected that the new pulp will be suitable for a wide variety of papers, rayon manufacture, and conversion to alpha-cellulose pulps. The new process is notable as having succeeded in producing acceptable pulp from bamboo where the sulphite process failed.

Whereas in the alkali process about 500 pounds of lime and 300 to 500 pounds of soda ash or salt cake are required per ton of pulp manufactured, the new process needs no chemicals for successive cooks other than to make up the small mechanical losses of solvent in the washing and recovery steps. Transportation of chemicals is drastically reduced—an important item, as the bamboo growing regions are usually a great distance from industrial centers.

Although the manufacturing cost cannot be estimated adequately in small scale laboratory operations, the new process has an advantage over the alkali process because the hydrotropic solution can be used several times before reclamation, while the alkali spent liquor can not be re-used. This means, in the new process, a smaller cost in the recovery of chemical and also efficient utilization of the sensible heat of the cooking solution.

The lignin, which is obtained in the new process as a solid by-product, will await new developments for its uses. If it be burned in the furnace it will supply most of the heat needed in the process.

EXPERIMENTAL PART

Apparatus, Bamboos, and Chemical

The apparatus used for this study consists of a bomb made of stainless steel, approximately 9 inches high and 3 inches in diameter, with a capacity of about 500 cc. Heat was supplied by an oil bath which contained an electric heater, a stirrer, a thermometer, and mercury constant temperature regulator which was capable of maintaining the temperature constant to plus or minus 0.1 deg. C. The bomb had been tested to stand 300 pounds pres-

sure and the oil, a black steam oil, could be heated to 200 deg. C. without fuming.

Two kinds of bamboo were used for this work—*Phyllostachys bambusoides* and *Bambusa tulda*. Both of them are giant clump-forming bamboos, from 2 to 3 inches in diameter. They were supplied by the Bureau of Plant Industry, United States Department of Agriculture. The *Phyllostachys bambusoides*, grown in the plant introduction garden near Savannah, Georgia, had thin walls and was about 2 or 3 years old. The *Bambusa tulda*, grown in the plant introduction garden near Coconut Grove, Florida, had very thick walls. Its age was not specified.

The sodium xylenesulphonate used for the cooking solution was a product of the Chemical Engineering Laboratory. The salt was purified by recrystallization from water and an assay made by the Parr sodium peroxide bomb method to determine the total sulphur content. Small amounts of sodium sulphite and sodium sulphate determined by extraction with alcohol were found negligible. The cooking solution was made by dissolving the purified sodium xylenesulphonate in water. Allowance was made for the purity determined by the assay. Concentrations of the solution are stated in percentage by weight.

Pretreatment and Cooking

The bamboo was first sawed into ¾-inch sections and then cut lengthwise into small pieces to accommodate them to the small laboratory roll. In plant practice the splitting would not be necessary. The pieces were then crushed several times in the laboratory roll crusher, with rolls set at ⅛-inch distance. Fines were removed by screening and the crushed bamboo was spread out and allowed to dry in the air at room temperature to a moisture content of 7 to 10 per cent. The dried material was then kept in a closed container and its exact moisture content determined by drying a sample to constant weight at 105 deg. C.

Fifty grams of bamboo of known moisture content were put into the bomb and 340 cc. of solution added so that there was about 1 inch of air space left in the bomb. A circular piece of copper gauze was then inserted within the bomb a little below the solution level to prevent the bamboo from floating. The bomb cap was screwed tightly into place and the bomb deposited in the oil bath. It took about one hour for the bath to attain the maximum temperature.

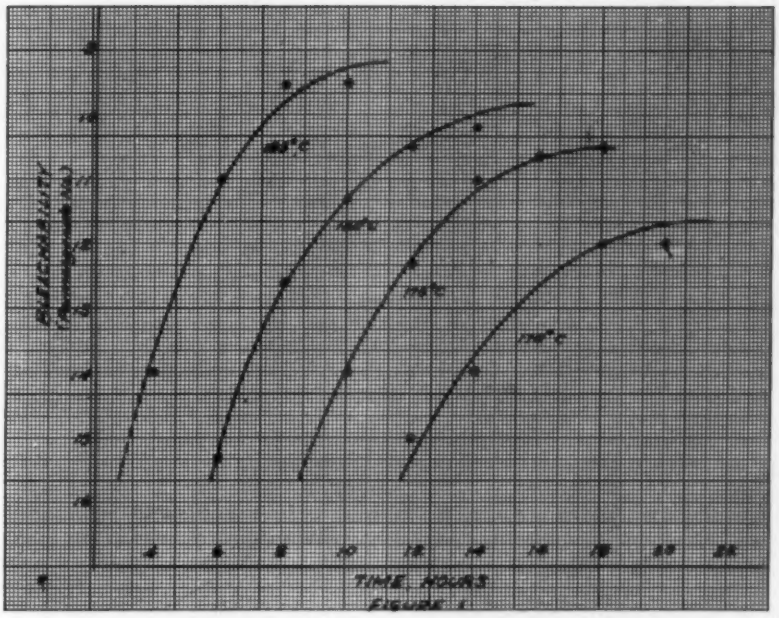


FIGURE 1

Washing and Bleaching

After digestion the bomb was cooled, opened, and the solution drained from the pulp. The pulp was washed with a solution of sodium xylenesulphonate, the concentration of which was approximately 20 per cent. It was so adjusted that there was no precipitation of lignin. This process was repeated several times, first with an old solution and finally with fresh solution until the washing solution came out with only a faint color. At each wash the pulp was allowed to remain in the wash solution for about 15 minutes at room temperature. Finally, the pulp was washed three times with tap water to remove the sodium xylenesulphonate completely from the pulp as shown by ash determination of the pulp.

The degree of cooking or bleachability of the pulp was represented by the permanganate number or by the percentage of lignin (72 per cent sulphuric acid). The Standard TAPPI method was used for the determination of permanganate number *(20)*. In the case of bamboo pulp about one-half of one per cent more of chlorine was found to be needed for a white pulp than for sulphite pulp.

The bleaching was carried out in three stages. Ten grams of air-dry pulp were placed in 500 cc. of fresh water and allowed to stand about 2 hours until the pulp was thoroughly soaked. To this 2 per cent pulp suspension there was added about 60 per cent of the total chlorine required in the form of chlorine water and the mixture allowed to stand for half an hour. The second stage consisted in making the batch alkaline with a slight excess of sodium hydroxide and permitting the batch to stand for several minutes. The pulp was then filtered on a Büchner funnel and thoroughly washed with water. The third step, the alkaline bleach, consisted in treating a 3 per cent consistency of pulp for 3 hours at room temperature with a solution of sodium hypochlorite containing 40 per cent of the total chlorine required for complete bleaching. After the last stage was accomplished the pulp was washed several times with water on a Büchner funnel. The pulp must be allowed to stand in water and then be thoroughly washed each time. Otherwise the pulp would become dull after drying.

I. Effect of Temperature and Cooking Time

A series of cooks has been made on *Phyllostachys bambusoides* at various temperatures and for different times with a 50 per cent solution of sodium xylenesulphonate. The results are shown in Table I and a plot of the bleachability, or permanganate number, against the cooking time is presented in Figure 1.

Figure 1 indicates that for a given temperature the amount of lignin removed in unit time is almost constant during the first few hours of heating, but it then decreases with further heating until, after a certain period, the permanganate number tends to become a constant; that is, an equilibrium point is reached. Prolonged heating beyond this equilibrium point would result in an increase in permanganate number rather than in a further decrease. The reason for this may be attributed to the decomposition

of the pulp. Figure 1 also indicates that temperature is the more important factor for the solution of lignin. At higher temperatures not only is the lignin more completely removed, but the time of cooking is considerably decreased. The general relationship can be stated here that for a given bleachability an increase of 10 degrees of temperature reduces the cooking time to about one-half.

Table I shows that for a chlorine consumption of 6 per cent a yield of 35 per cent unbleached pulp and a yield of about 34 per cent bleached pulp may be obtained. The same result is obtained if the cooking is continued for 16 hours at 175 deg. C. or for only 12 hours at 180 deg. C. At 185 deg. C. the cooking time required is 7 hours but the yield of bleached pulp drops to about 32 per cent. At all temperatures the alpha-cellulose content remains practically constant at approximately 93 per cent, which shows that little degeneration of the cellulose occurs below 185 deg. C. The drop in yield at higher temperatures is probably due to removal of hemicellulose.

Cooks have also been made at the two extremes; namely, 160 deg. C. and 190 deg. C. At 160 deg. C. an extremely long cooking time is necessary and the removal of lignin is rather incomplete. At 190 deg. C. both cooking time and lignin content are low, but the yield is too low. Some of the results for two varieties of bamboo are shown in Table II.

II. Effect of Concentration of Solutions

Cooks of *Phyllostachys bambusoides* were made at 185 deg. C. for 7 hours using various concentrations of fresh hydrotropic solutions. The results are shown in Table III.

It has been previously established *(19)* that the dissolving power of hydrotropic solutions increases with concentration. Table III shows that there is a range within which the concentration of the solution can be changed without seriously affecting its solvent power. The difference in effect between a 50 per cent solution and a 35 per cent solution is small, but there is a saving of 30 per cent of chemical in the 35 per cent solution as compared with the 50 per cent solution. Still more important is the fact that it points to the possibility of direct steam digestion. A 60 per cent solution would be too high a concentration because the used liquor becomes a thick paste at room temperature so that its separation from the pulp is difficult. On the other hand, the solution loses a great deal of its dissolving power when the concentration is brought below 30 per cent.

Table I

Temperature °C.	Cooking Time Hr.	Yield Unbleach. % Dry Bamboo	Permanganate Number	Chlorine % Dry Pulp	Yield Bleach. % Dry Bamboo	Cellulose % Dry Bleached Pulp
170	12	35	15	8.6	33	..
170	14	..	14	8.6	..	..
170	18	36	12	7.5	34	..
170	20	34.5	12	7.5	32.4	..
175	10	36	14	8.2	34	92.4
175	12	36	12.3	7.5	34	93
175	14	36	11	6.5	33.6	93
175	16	34	10.6	6	32	93
175	18	36	10.5	6	34	93
180	6	37.5	15.3	8.5	35	93
180	8	36	12.6	7.5	33.5	94
180	10	36	11.3	6.5	34.7	94
180	12	35	10.5	6	34	94
180	14	31	10.2	5.5	29	..
185	4	36	14	8	33.5	93
185	6	35	11	6.5	32.5	94
185	8	33.4	9.5	5.5	31	94
185	10	32.6	9.5	5.5	30.4	93.7

Table II

Temperature °C.	Cooking Time Hr.	Yield Unbleached Pulp % Dry Bamboo	Lignin % Dry Pulp	Chlorine % Dry Pulp	Yield Bleached Pulp % Dry Bamboo
	Phyllostachys bambusoides				
160	17	41	6.7	11	37
160	20	40	4.8	8	36
160	26	37	3.8	6.7	35
190	6	33	2.6	5	31
	Bambusa tulda				
160	23	44	7.7	13	39
160	30	42	5.1	9	39
190	4.5	35	5.6	10	33
190	6	37	3.0	5	35
190	7	36	3.4	6	34

Table III

Conc. of Solution	Permanganate Number	Yield Unbleached % Dry Bam.	Chlorine % Dry Pulp	Yield Bleached % Dry Bamboo
50	8.5	36	5	33
45	9.3	35	5.5	32
40	10.8	35	6.2	32
35	10.6	36	6	33

III. Cooking of the Nodes

Bamboo nodes have generally been considered hard, giving only a low yield of short fibered pulp. In this experiment, nodes of *Phyllostachys bambusoides* were treated in the same manner as the internodes and were cooked with a 40 per cent solution at 185 deg. C. for 7 hours. The result was found to be excellent.

Yield, unbleached	36 per cent
Chlorine used	5 per cent
Yield, bleached	33 per cent
Permanganate Number	8.1
Alpha-cellulose (bleached pulp)	94 per cent

Satisfactory results have been obtained also with mixtures of internodes and nodes. Therefore, the whole stem can be used.

IV. Effect of Organic Materials in the Bamboo on the Solvent Power of the Solution

Four hundred fifty cubic centimeters of a 40 per cent solution were used to cook 50 grams of bamboo at 185 deg. C. for 7 hours. The cooking liquor was then separated from the pulp by suction and used for the next charge. There was always about 70 cc. of liquor carried away with the pulp. This loss was made up by adding fresh solution to the next charge. The concentration of the organic materials extracted from the bamboo was thus built up in the solution as the number of cooks increased. The results are shown in Table IV.

The ability to use the cooking solution many times means that only a small proportion of the solution has

Table IV

Cook No.	Organic Materials in Soln. Used g/100 g. Fresh Soln.	Yield		Permang. No.	Cl Used	Alpha Cellulose
		Unbl'ch.	Bl'ch.			
		% Dry Bamboo			% Dry Pulp	
1	0	35	32	10.8	6.2	93
2	8.3	33	31	8.6	5	93
3	10.7	35	32	10	6	94
4	14.5	33	31	8	5	92
5	18.5	35.6	33	9.4	5.5	92
6	21.2	33.5	31.5	9	5.5	93
7	24.4	35	32	9.8	6	93
8	26.6	33	30	8.5	5	93

to be treated for recovery of chemical per ton of pulp. This is an economic advantage of the new process as compared with the alkali process where nearly the whole bulk of spent liquor has to be treated for recovery of chemicals. In practice, when the separation of liquor was effected by draining only it was found that a considerable quantity of liquor was carried away with the pulp. If the loss is made up by adding fresh solution for the next cook the amount of dissolved organic material in the liquor will be found nearly constant. The portion of liquor which has been carried off with the pulp will go through the recovery process and be used again.

When the liquor is used for the succeeding cook most of the sensible heat of the liquor is utilized. That is, a hot solution is ready for the next cook. The sensible heat of the cooking liquor is the largest item of heat consumption per ton of pulp in all commercial cooking processes. Hence the new process also possesses the advantage of great heat economy.

Although the liquor from the eighth cook could still be used it had become so viscous that its separation from the pulp was difficult. Table IV shows that the solution still possesses full dissolving power up to the point where the solution is too viscous and a recovery operation seems to be necessary. There were no objectionable by-products formed after such a long time of heating at high temperatures. Therefore, the accumulation of lignin and other organic material in the solution was without any effect on the solvent power of the solution or the properties of the pulps. The old solution is as good as the fresh one.

V. Cooking for High Yield

It was found that most of the lignin of the bamboo can be removed rapidly at a relatively low temperature of 160 deg. C. It is only a small proportion of the lignin which requires a higher temperature for its solution. Since high temperatures would cause a low yield, it is reasonable to cook the bamboo at two or more stages of temperature so that it is exposed to the high temperature for a relatively short time. The anticipated high yield was obtained experimentally.

Because there are so many possible combinations of temperature and time the following cooking schedule shown in Table V was chosen as an example. The yield of pulp shown in Table V was the average of four cooks. The concentration of the cooking solution used was 40 per cent.

Table V shows that the bamboo contains 29 per cent of lignin, 70 per cent of which can be removed by 6 hours of heating at 160 deg. C. The remaining lignin is more resistant to treatment. It takes 7 to 8 hours of heating at higher temperatures to bring down the lignin to 5 per cent of the total amount in the bamboo as shown in cook No. 4. It is, of course, easier to produce a strong brown pulp of high lignin content from bamboo than to produce a bleachable pulp.

The increase in yield is remarkable. It is about 40 per cent of bleached pulp for *Phyllostachys bambusoides* and about 44 per cent bleached pulp for *Bambusa tulda*. The amount of chlorine required for bleaching is low.

The above example of cooking by temperature stages shows better results than the runs at constant temperatures and may be considered the preferred cooking procedure.

VI. Chemical Tests of Pulps

The methods used for the chemical tests are the standard methods of the Forest Products Laboratory *(3)*, except for the permanganate number and the cuprammonium viscosity which are standard TAPPI methods *(7, 20)*. The results are shown in Table VI (A, B and C). All the figures are percentages based on the weight of oven-dry pulp except the viscosity and the yield (see table). The concentration of the solution for all the cooks is 40 per cent.

Table VI (A and B) shows that the ash content of the pulp is very low; that is, of the order of good wood pulps. The values for alpha-cellulose in all cases, and the value of viscosity when cooked at 170 deg. C., or at the optimum conditions, are higher than for ordinary wood pulps. The value of the copper number, which is 1.7 to 2.4 of the bleached pulp, and the solubility in hot dilute alkali are both somewhat high, being of the order of sulphite pulps.

Operating at higher temperature removes pentosans in the pulp from about 12 per cent at 170 deg. C. down to about 5 per cent at 185 deg. C. At the optimum conditions the value is 8 per cent. The high value of pentosans is inherent from the bamboo which originally contains 20 to 30 per cent of such materials *(32)*.

Although the value of alpha-cellulose remains high in the pulps for cooking temperatures up to 185 deg. C., the viscosity shows a drop at high temperatures. The excellent preservation of alpha-cellulose and a not very

Table V

Cook No.	Cooking Conditions Hr.	Cooking Conditions Temp. °C.	Lignin % Dry Pulp	Yield Unbl'ch. % Dry Bamboo	Perman. No.	Cl Used %	Yield Bl'ch. % Dry Bamboo
Phyllostachys bambusoides (Contains 29% *lignin* on the weight of the bamboo)							
1	6	160	15				
2	6	160					
	4	175					
	—						
Total	10		6.5				
3	6	160					
	4	175					
	2	185					
	—						
Total	12		5.5	41.4	15	8	39
4	6	160					
	4	175					
	3½	185					
	—						
Total	13½		3.8	41.6	9.5	5	39.5
Bambusa tulda							
5	6	160					
	4	175					
	4	185					
	—						
Total	14		4.5	46	13.5	6.5	43.6

low viscosity of about 16 centipoises even at 185 deg. C. for 7 hours show that the hydrotropic solution, owing to its mildness, causes but little degradation of the cellulose.

Bambusa tulda is better than *Phyllostachys bambusoides,* not only in yield, but also in viscosity and copper number and, further, is a little higher in alpha-cellulose.

The best viscosity of the bleached bamboo pulp is 30 to 40 centipoises which is higher than for ordinary wood pulps *(1)*. This will, in general, indicate good physical strength of the pulp and less degeneration *(4, 33)*. This is an important property of the pulp in relation to its uses for papermaking and for the manufacture of cellulose derivatives, and is an advantage of this new process.

VII. Separation of Lignin from Used Solutions

The separation of lignin is effected simply by adding water to the cooking liquor. The precipitated lignin is yellowish brown in color and has a colloidal character. It coagulates readily on heating and can be filtered from the liquor while hot. The cooking liquor can then be concentrated and used directly in the process. It has been pointed out *(19)* that for evaporation economy it is not necessary to remove all the lignin from the liquor, but to add a certain amount of water sufficient to cause the precipitation of most of the lignin and to allow the remaining lignin to go back to the process.

Concentration of solution (before use)	40.7 per cent sodium xylenesulphonate per 100 parts by weight of original solution
Organic matter from bamboo	29.5 g. per 100 g. of original solution
Specific gravity	1.13 at 25 deg. C.

The cooking liquor from this experiment had the above analysis. Water was added to the liquor in different quantities. The precipitated lignin was heated on a hot plate, filtered on a suction filter, and washed with a solution of sodium xylenesulphonate of approximately the same concentration as the filtrate. This was followed by washings with water. The lignin was then dried at 105 deg. C. and weighed.

The results plotted in Figure 2 show that in the liquor the total organic material from bamboo is about 30 grams per 100 grams of original solution, from which 20 grams of lignin can be precipitated and 10 grams of residual soluble material remains in solution. Under such conditions no precipitation occurs when the concentration of the solution is above 25 per cent. About 70 per cent of the lignin can be removed by adding an equal volume of water and 90 per cent of the lignin by adding 1.5 volumes of water to one volume of liquor. Precipitation is complete when 5 volumes of water are added to one volume of liquor.

With a different concentration of the original solution and a different amount of lignin and soluble material in the liquor, the position of such a curve would change accordingly, but it might be expected to preserve the same characteristic shape.

However, the amount of lignin not precipitated will depend upon the concentration of the solution, if the effect of soluble material on the solubility of lignin is neglected. From the curve one can see that when the concentration of the solution is 15 per cent the amount of lignin remaining in solution is about 2 grams per 100 grams of original solution. Practically no lignin remained in solution when the concentration of the solution was 10 per cent.

Some fermentable hexoses were at first expected to be present in the cooking solutions but the determination of hexoses by the fermentation method gave negative results. In a control experiment with a small amount of dextrose in the solution fermentation was found to take place readily, showing that the solution itself did not inhibit yeast growth.

The water soluble organic material may be considered as an inert component of the solution. The separation of the sodium xylenesulphonate from this soluble organic material has been accomplished by crystallization.

Table VI (A)

Unbleached Pulp	*Phyllostachys bambusoides*		*Bambusa tulda*
	10 hr. at 170° C.	7 hr. at 185° C.	7 hr. at 185° C.
Yield (% oven-dry bamboo)	37.	35.	40.
Ash	0.15	0.17	0.19
Lignin (72% H_2SO_4)	8.1	3.0	4.0
Permanganate Number	19.2	10.2	15.0
Chlorine, used	12.0	6.0	8.0
Alpha Cellulose	92.0	93.4	94.0
Copper No. (Staud & Gray)	2.7	2.8	2.3
Pentosans	11.2	4.8	4.4
Cuprammonium Viscosity (centipoises)	40.	27.	32.
Cold Water Solubility (24 hr. at room temp.)	0.1	0.2	0.17
Hot Water Solubility (1 hr. at 100° C.)	0.3	0.4	0.5
Alcohol-Benzene Extraction	0.48	0.17	0.21
Hot 1% Alkali Solubility (1 hr. at 100° C.)	10.0	10.4	8.5
Cold 1% Alkali Solubility (1 hr. at room temp.)	2.2	1.0	1.7

Table VI (B)

Bleached Pulp	*Phyllostachys bambusoides*		*Bambusa tulda*
	10 hr. at 170° C.	7 hr. at 185° C.	7 hr. at 185° C.
Yield (% oven-dry bamboo)	34	32	37
Ash	0.18	0.18	0.16
Alpha-Cellulose	92.3	93	93.3
Copper No. (Staud & Gray)	1.7	2.4	1.8
Pentosans	11.7	4.8	....
Cuprammomium Viscosity (centipoises)	31.0	15.6	16.8
Cold Water Solubility (24 hr. at room temp.)	0.13	0.16	0.10
Hot Water Solubility (1 hr. at 100° C.)	0.48	0.4	0.21
Cold 1% Alkali Solubility (1 hr. at room temp.)	1.2	0.9	1.4
Hot 1% Alkali Solubility (1 hr. at 100° C.)	9.5	11.0	9.0

VIII. Properties of Bamboo Lignin

1. Yield: 30 grams of dry bamboo was cooked with 450 cc. of 50 per cent solution at 185 deg. C. for 7 hours. The liquor was diluted with 10 volumes of water, boiled, filtered, washed with water, and the lignin dried at 105 deg. C. The yield was 10.6 grams or 35 per cent on the weight of dry bamboo.

2. The ash is 0.97 per cent on the weight of dry lignin.

3. The lignin contains no pentosans and no sulphur.

4. The solubility of the lignin in some of the common solvents is shown in Table VII.

Table VI (C)

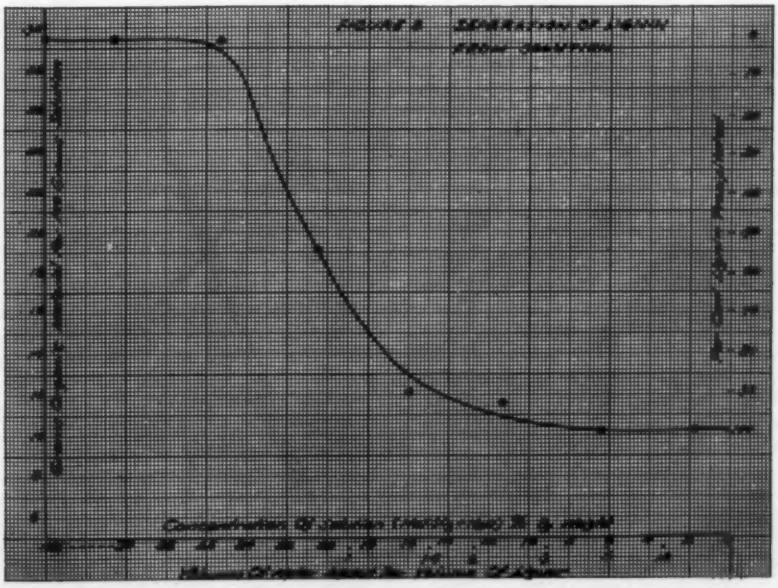
Unbleached Pulp	*Phyllostachys bambusoides*	*Bambusa tulda*
	6 hr. at 160° C. 4 hr. at 175° C. 3½ hr. at 185° C.	6 hr. at 160° C. 4 hr. at 175° C. 4 hr. at 185° C.
	13½ hr., Total	14 hr., Total
Yield (% oven-dry bamboo)	41.6	46
Lignin	3.8	4.5
Permanganate Number	9.5	13.5
Chlorine, used	5	6.5
Alpha-Cellulose	93.6	93.5
Copper No. (Staud & Gray)	2.7	2.6
Pentosans	8.2	8.0
Cuprammonium Viscosity (centipoises)	40	44
Bleached Pulp		
Yield (% oven-dry bamboo)	39.5	43.6
Alpha-Cellulose	92.5	93.6
Copper No. (Staud & Gray)	2.2	1.8
Cuprammonium Viscosity (centipoises)	30.5	41.2

This sample of lignin prepared above was by no means pure nor did it consist of a simple lignin compound. Hence, solubilities should not be given in exact percentages. The solubility in methyl and ethyl alcohols and in acetone is of the same order, about 70 per cent. The lignin can be resolved into two components, one of which is soluble and the other less soluble in simple alcohols and acetone.

5. Two fractions of lignin were prepared. A concentrated liquor which had been used for five consecutive cooks at 170 deg. C. for 10 hours was diluted with an equal volume of water. The lignin thus precipitated was heated, filtered, washed, and dried at 105 deg. C. The filtrate, which still contained lignin, was further diluted with another equal volume of water and a second fraction of lignin was thus obtained. The first fraction had a yellowish color and partly became a colloidal suspension after washing and standing some time in water. The second fraction was different. It coagulated on heating into a black fragile solid and could be washed and filtered easily.

6. The methoxyl content was determined by the Zeisel method as modified by Pregl for microchemical analysis *(23)*. The first fraction above was found to have a methoxyl content of 14.8 per cent and the second fraction, 15.4 per cent. This shows that bamboo lignin fractions may be separated into more uniform portions by means of fractional precipitation.

A sample of poplar lignin which was obtained by the hydrotropic solvent method at lower temperatures was supplied by Dr. Pelipetz and showed a methoxyl content of 15.7 per cent. The difference in methoxyl content between the poplar lignin and the bamboo lignin is small and their similarity in behavior towards solvents *(19)* leads to the supposition that wood lignin and bamboo lignin are closely related.



DISCUSSION

Pretreatment of Bamboo

It was found in the preparation of bamboo for this work that crushing does not produce uniform samples of bamboo. Too much fines and undigested shivers appear in the resulting pulp. Cook No. 4 in Table V was modified so that the bamboo was leached in water and crushed while wet to a less fine state. The result was a slight gain in yield as compared with cook No. 3. Several cooks have also been made with the bamboo cut into small thin blocks without any crushing. The rate of delignification was found to be little different, but the uniformity of digestion was noteworthy.

It is advisable to have the bamboo chipped in the case of *Bambusa tulda*, which is almost solid due to the extremely thick wall structure; or roughly crushed to split the culm and then broken into a definite length in the case of thin-walled bamboos like *Phyllostachys bambusoides*, thus taking advantage of the high specific gravity of bamboos to increase the digester capacity and cut down on the manufacturing cost.

Table VII

Dilute sodium hydroxide solution	Soluble
Water	Insoluble
12 per cent Hydrochloric acid	Insoluble
Benzene	Insoluble
Ethylene dichloride	Slightly soluble
Chloroform	Partly soluble
Methyl alcohol	Partly insoluble
Ethyl alcohol	Partly insoluble
Acetone	Partly insoluble

Green and Yorston *(12)* found that crushed wood which has suffered mechanical stress results in fiber degradation and formation of weak sheets in the case of the sulphite process but this has not been confirmed for bamboos in the hydrotropic process.

Nature of the Reaction

Unlike most of the organic pulping agents such as phenols, alcohols, glycols, dioxime, etc., which all contain hydroxyl groups that are liable to form condensation products with lignin in the presence of an acid or alkali as reviewed by Bailey *(2)*, there is no chemical combination between sodium xylenesulphonate and lignin. If chemical combination did occur the sulphonic acid group would be expected

to be the active agent but the lignin was found to contain no sulphur. Furthermore, Table III demonstrates that a variation of the cooking solution from 35 to 50 per cent has no effect on the rate of delignification. Thus the solution of sodium xylenesulphonate in this new process behaves merely as a solvent.

The reaction, in addition, is not simply a solution or diffusion process alone. The rate of a diffusion process would be determined by the concentration of lignin in the solution and the concentration of the saturated solution at the interface of the solid lignin —the latter being a constant as long as there is lignin present. Table IV shows that the rate of delignification is almost the same for the fresh as well as for the used solution. In the used solution both the lignin concentration and viscosity have increased. The sudden change of slope of the time-bleachability curve in Figure 1 is also against the concept of a simple diffusion process because at that point the solution is far from saturation while lignin is still present in considerable quantity.

The requirement of higher temperatures for the complete removal of the residual lignin indicates that the lignin present in bamboo is not of a uniform nature. According to Bailey *(2)*, there are two kinds of lignin in wood, one of which is free, and the other in combination with cellulose. He found that all the lignin in poplar is free while about 20 per cent of the lignin in pine is in a combined form. The extremely slow reaction which controls the rate at the end of this process must be one which consists of either a depolymerization or the destruction of the chemical bond of the more resistant lignin in the bamboo. This kind of resistant lignin seems to increase in amount with the age of the bamboo. Sala *(31)*, in his alkali pulping of bamboo, found that a higher temperature of 170 deg. C. is required for old bamboos instead of 156 deg. C. in the usual case. Vidal and Aribert *(34)* reported that for papermaking the bamboo should be cut young—about 2 to 3 years old. If allowed to grow older, it becomes lignified, hard, colored, and requires more drastic cooking conditions, and gives a pulp which will not bleach so well.

Some gas is formed in the hydrotropic cooking process and causes slight pressure in the digestion bomb. Gas bubbles can be seen in the solution after releasing the pressure. The gas has a particularly agreeable smell and contains carbon dioxide. Volatile acids, such as ascetic acid, have also been found in the solution in small amount.

The solution of sodium xylenesulphonate is neutral but the cooking liquor is weakly acid with a *p*H value of 4.3 to 4.8 derived from the organic acids of the bamboo and the carbon dioxide which is dissolved in the solution. Additions of acid and alkali to the solution for catalytic purposes have been tried without much practical importance. With a little acetic acid, 2 to 5 cc. per 500 cc. of solution, a soft pulp can be obtained. With more acetic acid the pulp tends to become black and the yield is lowered. Small amounts of sodium hydroxide, 5 per cent on the weight of dry bamboo, were found to be neutralized at the end of the cook and the solution still acidic.

Yield, Bleachability, and Species of Bamboo

The best yield of *Bambusa tulda* is about 46 per cent and that of *Phyllostachys bambusoides* 42 per cent of unbleached pulp. This is about 6 per cent lower than that possible to obtain from soft wood, but is considered satisfactory in the case of bamboo. Raitt *(24)* obtained the highest yield of 45 per cent unbleached pulp among several species of bamboo he tested, but soda pulps are apt to contain a much higher percentage of pentosans than this pulp which has a pentosan content of only 8 per cent.

Under optimum conditions there is about 4 per cent of lignin remaining in the unbleached pulp and the chlorine used is 5 per cent in the case of *Phyllostachys*. The lignin content can be further lowered by cooking a longer time at the higher temperature but with a sacrifice of yield and other properties of the product. Eatwood *(8)* calculated the economic balance of a commercial sulphite cook and found that the sulphite pulp with a bleachability of 6 per cent chlorine has the highest net profit. He also found that one per cent of lignin in the pulp will require 1 to 2.64 per cent of chlorine for the bleaching. In this bamboo pulp under optimum cooking conditions 1 per cent of lignin requires about 1.3 per cent of chlorine. This is satisfactory.

The cooking conditions, as well as the properties of the resulting pulps, are subject to change to some extent according to the species of bamboos under consideration. In this study, *Bambusa tulda* shows superiority to *Phyllostachys bambusoides* in all respects, although it is more resistant and requires a somewhat longer cooking time. Another species of small bamboo, the *Bambusa tuldoides,* has been tested and found to cook easily at 160 deg. C. It can be bleached readily with a yield similar to that of *Phyllostachys bambusoides.* Raitt *(24)* found the best species of bamboo belong to the "Ochlandra" group which has a silky fiber of maximum length, 8.5 mm., and an average length of 4.38 mm. There is still opportunity for the discovery of better species of bamboos which would permit lower cooking temperatures and offer better yield and better fiber properties than the two kinds of bamboos represented in this study. However, the species studied are among those available in largest quantity and at best locations.

Characteristics of the Pulp and Its Potential Uses

Because the hydrotropic solvent has no chemical action on the cellulose the bamboo pulp produced by this method is characterized by its very small degree of hydrolysis as shown by its high alphacellulose content and its high viscosity and lack of sugar in the residual solvent. Such a pulp, in general, would have outstanding physical properties in the same sense as pulps produced by the neutral sulphite or Keebra process *(5)* and by the sulphite process. The strength of these pulps may be attributed to the mild pulping agents employed.

However, the presence of weak acids in the cooking solution, the high temperature, and the long cooking time have some hydrolytic effect on the resulting pulp. The acid hydrolysis helps in the decrease of pentosans from 20 to 30 per cent in the original bamboo to 5 to 8 per cent in the pulp. This figure is on the upper margin of the pentosan content of sulphite pulps but is lower than that of sulphate pulps. Both sulphite and sulphate pulps are obtained from low-pentosan-content coniferous woods. Richter *(30)* remarked that the pentosans in sulphite pulps have suffered hydrolysis from the cooking acids and are rendered more soluble in dilute alkali than the less hydrolyzed pentosans of the sulphate pulps. That some hydrolysis of pentosans has occurred in the bamboo pulp is shown by its high alkali solubility and its copper number.

The new pulp should be compared with sulphite pulps rather than with sulphate pulps because of the slightly acidic cooking solution employed in the new process. Some analytical data from Aronovsky and Dryden *(1)* in commercial pulps are reproduced in Table VIII for reference. Since pulp properties can be changed to a considerable extent by changing the pulping procedure and the use of slightly different analytical methods, the comparison can be made only in a general way.

It is evident that the bamboo pulp is better than the easy-bleaching sulphite pulps in respect to alphacellulose

and viscosity. The bamboo pulp contains less degenerated cellulose and is, therefore, purer. It is comparable to the alpha pulps except with respect to its higher pentosan content, higher dilute alkali solubility, and higher copper number. It may be concluded that, as far as the composition is concerned, the bamboo pulp produced by the hydrotropic process lies between the sulphite and the alpha pulps.

Judging from the good characteristics of the bamboo fibers (page 10), the mildness of the hydrotropic process, and the excellence of the composition of the resulting pulp, it appears fairly certain that this bamboo pulp can be manufactured into papers of very good strength. The presence of hydrolyzed pentosans would make the pulp more susceptible to hydration by heating, probably not so readily as sulphite pulp but more easily than sulphate pulp *(16, 30)*. If better beating properties are desired the bamboo pulp can be rendered softer by adding a little acetic acid to the cooking solution and prolonging the cooking time at high temperatures. Richter *(27, 28)* found that alpha pulps which contain only small amounts of hemicellulose have better flexibility, tearing and folding strength than ordinary wood pulps. Bamboo pulp is purer than ordinary sulphite pulps and can, therefore, be expected to have better tearing and folding strength, and can be adapted to a wide variety of papers, either used alone or as a furnishing.

The chemical properties of the bamboo pulp indicate that it can be used without refining for rayon manufacture.

The production of commercial alpha pulp can be accomplished more easily and more economically from the bamboo pulp because it already contains a higher content of alpha-cellulose and greater viscosity. It needs only the removal of pentosans which, for example, can be done by treatment with hot dilute alkali *(29)*.

SUMMARY

For the first time, bamboo pulp has been made by the use of a hydrotropic solvent and, also for the first time, bamboo bleached pulp having a viscosity of 30 to 40 centipoises and an alpha-cellulose content of 93 per cent has been obtained.

In the method found satisfactory to produce this quality of bamboo pulp, the bamboo was cut to a uniform length of about ¾ inch, crushed to about ⅛-inch splinters and treated with a 30 to 50 per cent solution of sodium xylenesulphonate at temperatures of 180 to 190 deg. C., preferably in separate stages of temperature rather than a straight run at constant temperature. New advantages are use of the bamboo nodes as well as internodes and repeated use of the liquor.

The resulting pulp has properties which point to its use for high-grade papers, for rayon manufacture, and its easy conversion into commercial alpha pulps.

On diluting the liquor with water the bamboo lignin precipitates and the used solution is returned to its original concentration by evaporation.

The bamboo lignin has characteristics similar to poplar lignin obtained by the same process. It is soluble in a number of organic solvents and can be separated by fractional precipitation into two portions with different methoxyl contents.

It is believed that this new process is suitable for the manufacture of pulp from bamboo, that it is superior to the alkali process now used for pulping bamboo in both quality of product and economy of heat and chemical consumption, and that it has great promise for China and other tropical and sub-tropical countries where bamboo is abundant and coniferous woods are scarce.

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Table VIII

Form of Pulp	Ash	Ether Extr.	Lignin	Pentosans	Alpha Cellulose	Alkali Solubility	Copper Number	Viscosity Centipoises
Hydrotropic bamboo,						(1% NaOH)		
Unbleached	0.17	0.35	3.5	5-8	93	10	2.6	42
Bleached	0.17	....	....	5-8	93	11	2	35
						(7.46% NaOH)		
Linters, treated	0.02	....	....	1.2	98	3.4	0.32	61.8
*Alpha	0.1	0.3	....	2.9	93.4	6.1	0.4	24.4
*Sulphite,								
Unbleached	0.4	0.4	1.9	5.1	79.3	22.2	3.1	84.2
Bleached	0.3	0.4	....	5.4	84.4	20.2	2.6	24.4
*Kraft, Unbleached	0.8	0.4	4.2	10.7	77.7	10.1	1.1	57.1
Bleached	0.7	0.2	....	11.3	82.8	21.5	2.4	14.6

(*)Extracts—Aronovsky and Dryden (1).

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TROUBLE *on the Paper Machine*

I - FOURDRINIER PART

ARCHIE McCAFFERY

● Numerous articles in the literature of the pulp and paper industry treat of the paper-making machine, either in its entirety or some part or section of it. Probably, without question, most of these articles have been written by engineers associated with firms manufacturing paper machines or necessary adjuncts to them, or by paper mill engineers. Seldom, it is believed, has the machine tender taken it upon himself to use the written word for discussing the machine that is under his direct observation and supervision.

● It is with pleasure, therefore, that the author of the accompanying article (the first installment of a series on paper machine troubles) is introduced. He is a machine tender with a background of more than forty years of experience. This experience covers work in 16 different mills.

● In this series of articles, the author cites paper-machine troubles which he has experienced during his years of service, explains causes for them, and tells what to do to make the corrections—a series of practical articles by a practical man.

▸▸▸ IT WAS IN 1805 that Marchant Warrell became the first paper-machine tender through his operation of a Bryan Donkin fourdrinier, the first commercially successful paper-making machine, in a mill at Two Waters, Hertfordshire, England. This machine was simple compared with paper machines of today, only 60 in. wide and without dryers or calender; yet Marchant Warrell had his troubles. So has each machine tender that has come after him. In fact, the skill of a machine tender is recognized in his ability to minimize trouble on a machine and in the handling of it.

Possibly the easiest way to discuss paper-machine troubles is to start at the wet end and to follow through to the dry end. Such a procedure is streamlined and reduces the tendency of overlapping which might develop if troubles are discussed in their relative order of importance.

▸▸▸ On this basis, perhaps, a start can be made with a *consistency regulator* that *shuts off* the *water when* the *stock is heavy and needs it.* If the regulator works on the crooked pipe principle, it is possible that it is being supplied with stuff that is mostly broken paper and which was heated in the beater. Such stuff will make a circuit around the crooked pipe quickly, because it is hot, just the same as if it were thin. This action allows the float in the container to drop and shuts off the water.

Under such circumstances, the regulator should be shut off and the machine run without it until the stock again becomes normal, the machine tender in the meantime obtaining such control of stock consistency as possible through the use of the hand gauge.

There are a number of consistency regulators on the market. Each of them is based on certain definite principles; but all of them are designed to add water to the stock if for any reason an increase in density occurs.

If a *rotary screen runs over,* the only thing to do is to shut off the stuff. Then stop the wire and with a pressure hose blow out the plates until the cylinder is in position to function to capacity. It may be necessary to close the valve leading to the screen to accomplish this cleaning operation.

If the screen is under capacity, nothing will prevent it from running over.

Should the screen not catch readily on the start-up, begin with the paper light and afterward bring it up to weight gradually.

If a *flat screen runs over* and there are a number of them, it is not necessary to shut it down. A flat screen that is shut down because of this trouble will start hard unless part of the stock in the vat is heaved out on the floor. To overcome the trouble, close the valve leading to the screen, and use the pressure hose. When the screen shows symptoms of starting, let up with the pressure hose and let the screen start gradually. Otherwise, it will flood the wire. When once the screen is empty, the stock valve may be opened slowly. The valve should be opened the same number of turns that were required to shut it.

When *starting up after* a *shutdown,* the machine tender should be skeptical of the wheel position of the screen valves. He should know at all times the number of turns to run on them. Then, if any of the valves have been disturbed, he can determine it readily.

When *a screw comes out of* a *rotary screen plate,* some stock will get into the flume without the benefit of passing through the screen plates. This trouble may seem of little consequence but it will fill the sheet full of holes, if making high finish.

If the *sheet becomes full of holes,* check to see if a screw is missing from the plates. Certainly, no paper made while a screw is out can be shipped. It isn't necessary to replace a missing screw immediately. Simply whittle out a peg of wood and drive it into the hole out of which the screw came. The peg makes a most satisfactory temporary repair.

A *screen plate* of either a rotary or flat screen *may become loose,* causing the sheet to become filled with holes while passing the calenders. Have the plate tightened, as no salable paper can be made until the plate is secured.

The machine tender when coming on tour should make a survey of the entire machine. He should look for *slack set screws, a plug left out of the head box,* or anything else that may be out of order. If a plug is missing from the head box, it must be replaced, as more stuff has to be run when a plug

Consistency regulator shuts off water when stock is heavy ● Sheet full of holes
Screen runs over ● Screw comes out of rotary screen plate ● Screen plate loose
Starting up after shutdown ● Slack set screws ● Plug left out of head box
Tube rolls: shiver . . . mark sheet . . . coat over ● All tube rolls must turn
Bolts break off in tube roll brackets ● Rectifier roll refuses to run
Water acts irregularly on suction box surface ● Carrier rolls out of place

is out to keep the paper up to weight. Here is a chance for a complete upset. To insert the plug, some water must be shut off the screens or the wire may be flooded or stalled. In any event, the weight of the sheet will be upset and it will be a miracle if the sheet doesn't break. There is no way to know how much water to shut off. It would be better to shut off too much rather than too little.

The *rectifier roll* in the head box *may refuse to run.* The machine tender is in a poor way to make a sheet of paper until it is started. What to do depends altogether on what is causing it to be idle. If the chain is broken, the regular job belongs to a millwright. If the trouble is in the motor, the job belongs to an electrician.

All tube rolls must turn. If they do not, the wire will wear them out. The failure of a tube roll to turn may be caused by flat rollers, tight boxes, or lack of lubricant. If a roll cannot be started, let it down so that the wire will not contact it.

It is not an uncommon thing for *bolts* to *break off in the brackets supporting* the *tube rolls,* causing all of the tube rolls in that section to drop. Placing the hands on the parts bolted to the shake rail will indicate by feel if any of them have worked loose.

If a *tube roll marks* the *sheet,* it will have to be let down or snubbed until it can be taken out and straightened, or a new journal installed in it.

When *tube rolls* are being run at much greater speed than that for which they were designed, they *will shiver* and throw the stock above them. This action will not be continuous, since, when the roll shivers, it will lose time or slow up, and then it will again commence to gain momentum and repeat the process.

If there are many such rolls, it is plain that they are too light for the work and should be replaced by heavier or stiffer rolls. Surely no machine tender should be expected to form a sheet on a table with such rolls.

If the ends of the *tube rolls coat over,* the stock is getting under the deckle onto one of the rolls and then is relayed from one roll to another. This trouble can be overcome by playing water from a hose onto the roll end the stock first contacts.

The machine tender must be looking at all times for *cracks in the wire.* If a crack develops, the machine must be shut down and the crack sewed up. A sizable crack always causes holes in the paper.

A *slack edge in a wire* usually is caused by the gathering of stock on the couch, breast, or some of the carrier rolls. If a top couch is being run and the sheet has a bad edge (something that may happen any time), the edge will follow the jacket, wash off from the end, and spatter in every direction. Stock spattering against the face of the bottom roll will gather and work in between the roll face and the wire until it gets in far enough to slacken the wire edge.

A slack edge also is apt to develop when the wire has been trimmed so that stock from the deckle will follow along its immediate edge. This stock will collect on the bottom couch roll, a little at a time, working in between the wire and the roll and thus ruining it in a very short time.

Stock gathering on any of the carrier rolls will put *ridges in the wire* or give it a *slack edge* when too tight. Under similar circumstances, if the wire is a little less tight, no harm would be done. However, if the wire becomes slack on the edge or develops ridges or slack spots, it will have to be tightened.

Machine tenders, when running a double couch and guard board, sometimes cut off the *bevel of the guard board lip.* Instead of cutting the portion of the lip that protrudes down by the head of the jacket, a portion where the lip is contacting the end of the jacket outside the sheet is taken off. In so doing, space is left between the jacket and the lip which permits water and stock to get by. This stock will stick to the jacket and form a ring around it. The ring in turn will slacken the wire on that edge.

Sometimes the *wire will hang* to one side of the machine. There are various theories regarding the cause of this trouble. The most plausible theory is that the warp (threads running lengthwise) cuts grooves into the suction box covers and that the seam (stitched wire or soldered), when it comes along, lets the threads change position in the grooves, this movement continuing until the wire guide has to make the correction to keep the wire on the machine. Yet a wire with a welded seam, which should not lift when the seam reaches the boxes, acts just the same. There is no doubt, however, that grooves in suction box covers have a bearing on wire hanging, because a wire will cease to hang when an oscillator is run. The oscillator keeps the boxes in motion and the shaking of the wire breaks up the grooves.

True enough, if one of the *carrier rolls* worked *out of place,* the wire would refuse to stay on the fourdrinier; but a wire often will hang when carrier rolls are in perfect order.

In any event, a hanging wire is a bad thing; because, if stock leaves the wire when the guide is working hard to hold the wire on, the wire will run off the end of the rolls and be spoiled before the guide can right it.

If *slack spots in the wire* are found when coming on tour, report them immediately or else take the blame when a break occurs. Such spots may be caused by hosing stock off a carrier roll, starting up or shutting down without lifting the lump breaker or by a host of other things.

Sometimes an accident develops a *sizable hole in a wire.* If the hole is in that portion of the wire supporting the sheet outside the strip the squirt is taking off, it can do no harm except when running a top couch. In that event there would be danger of the hole leaving a deposit of stock on the bottom couch which would slack the wire and spoil it. If the hole occurs in that portion of the wire where the sheet normally is running, and it is in the middle of the week, a new wire will have to be put on. Otherwise the hole might be patched.

If a *wire becomes unmanageable,* running first to one side and then to the other, do not fail to check up on the set screws in the wire guide, especially the screws of the push rod. Often these screws will become loose and let the wire run the guide as if the fork was spread two inches apart. At other times, the rod will slip through its socket. In this latter case, the wire will run off the machine.

A machine tender coming on tour always should check on the *set screws in the wire guide as well as the fork and dog.* In spite of these precautions, the guide may become loose before the end of the tour.

If a *wire guide breaks,* shut down and have it fixed. No one expects a machine to run without a wire guide.

When *spots get on the wire* near the edge, they often can be removed while running. Simply tie the pressure hose

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Wire: cracks . . . slack edge . . . hangs . . . ridges . . . slack spots . . . sizable hole . . . gets away . . . spots . . . wrinkles . . . unmanageable • New wire • Wire guide breaks Set screws in wire guide • Spot breaks paper • Sheet with light edge Water slow leaving sheet • Filter on return water • Stuff is free Drop leg will not take hold • Pitch sticks to suction box • Head found in Impossible to get level sheet on wire • Covers of suction boxes fill up

where the stream will play squarely on the wire at the same distance in from the edge as the spot.

If the wire is old and the hose pressure strong, avoid *wrinkling the wire* by having the water contact it near a carrier roll.

If a spot is in on the wire so far that a stream cannot hit the wire squarely, the proper procedure is to shut down the machine and with kerosene and wire brush take off the spot. Sometimes, such a spot may be removed by breaking the paper and playing the pressure hose on the couch roll. Ordinarily, however, little is gained by bothering in this manner.

If there is a spot on the wire just inside where the water is trimming the sheet and it is undesirable to trim off any more paper with this water, the spot may be taken off with a pressure hose, or the wire may be run over to get the spot outside the water jet. If the spot is on the back side, set the pan in a short distance. Do not make any big jumps in doing it. If one-quarter of an inch is not enough to get the spot off the sheet, give the pan another quarter of an inch as soon as the guide straightens itself up. If the spot is on the front side, reverse the process—lengthen out the push rod.

Any time that a *wire gets away* in such an operation and goes over the end of the rolls or loses suction, stop it then and there, and shut off the stuff. The guide can be fixed easily when the wire is stopped; and it is better to lose a little time than to curl the edges of the wire.

If the machine is equipped with a suction roll and although the suction is lost, an experienced man might take a long chance in getting a wire back without stopping it. The idea is that it takes little adjusment on the guide roll to move the wire. If the rod is fumbled in handling after slackening of the setscrew, the guide will see-saw and run the wire from one side of the machine to the other, surely causing it to go over the ends of the rolls. Once the edge of the wire is over the ends of the rolls, an enormous cut of the guide roll is required to get the wire back. Because of the wide cut, the wire will run off on the opposite side as soon as it is again on the machine. The guide may right the wire sometimes, but often before it has the chance to do so the wire is off the machine and the edges are all curled up.

If a *spot breaks the paper,* do not try to remove the spot while running. Shut down and take it off.

If a *new wire* has been put on during the previous tour, it is a good procedure for the machine tender on the following tour to inspect the job most carefully. If the wire has been installed improperly, there is nothing to do but correct the mistakes. If a doctor is not being run against the breast roll, depending on a lip of the save-all to keep the breast roll wiped and that is not up against the breast roll, the sooner the machine is shut down and the lip of the save-all set up where it belongs, the better. The lip of the save-all cannot be left away from the breast roll, and it cannot be adjusted while running.

Stock, at times, may run in on the wire and leave a *sheet with a light edge.* If this condition is due to a poor deckle, the only thing that can be done is to report it and to get a new deckle. This condition also may be due to the breast roll being out of distance, to a poor fitting deckle, or to a wire that is slack on the edge.

If *water does not leave the sheet readily* on the wire and the sheet is not heavy, it would indicate that the stock has become slow. This condition can be corrected by creating more suction on the boxes, or by shutting off water at the screens. Where steam is provided, the machine stock may be warmed a little. Warming the stock will make it more free, and there will not be any disturbance of flow.

If the *stuff is free,* more water must be put on at the screens so that there will be more on the table. If the condition is quite pronounced, the first suction box may be closed partly, or, if using a single control unit, the first box should be given a little air to reduce its vacuum. This latter procedure has its advantages, since, when more water is added to the sheet, it washes all of the lumps off the flume and head box and they go over the machine and break the paper.

If a *filter is operated on the return water,* and the filtered stuff returns to either beater or machine chest, the stuff on the wire will become more free if, for any reason, the filter stops. In such event, no additional water should be added to the sheet. Rather, correct the difficulty by getting the filter started. If more water is added to the sheet, it will have to shut off again when the filter is again in operation.

The reason the stuff frees up when the filter stops is that the stuff is fitted for the machine in conjunction with which the filter is running. If it were otherwise, the stuff would be fitted differently.

The filter reclaims the finer fibers that have escaped the mesh of the wire; and the quality of these fibers, which borders on the infinite, becomes a large volume of stuff. This stuff, sluiced back into the chest and mixed with the stuff therein, gives the desired consistency for the sheet being made. When the filter stops, the consistency of this reserve is changed, thus making the stuff more free.

There are times when it becomes *impossible to get a level sheet on the wire.* The apron may be at fault, or the table may need lining up.

When *pitch sticks to the suction box,* it will leave an impression beneath the wire in the spot where located. This pitch will cause no trouble while running; but, before shutting down, the box should be shut off and let down. Otherwise, the pitch will stick to the wire. Then the box should be taken out and the pitch scraped off.

If the *covers of the suction box become filled,* they should be blown out. If this operation is not performed, it is not possible to tell whether the sheet is level when viewed from the floor.

There are a number of things that will cause *water to act irregularly on the surface of the suction boxes* other than irregular vacuum which is comparatively easy to locate. Needless to say, suction heads should be run on the edge of the sheet, vacuum connections should be tight, and, if running a pump, the driving unit should be working properly. Practically the same symptoms would be developed by a half stock pump taking air, by screen plate slots of odd sizes, by an irregularly woven wire, by unsteady power, etc. Only once in the author's experience was this trouble found to be caused by a suction box which had not been properly tightened up. With the vibration of a machine, such a box may ease up a little, just enough to let in a little air and then catch again—a trouble difficult to discover.

Sometimes when *planing suction box covers,* a cover will be planed like a

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Holes too small in suction box covers • Positioning suction heads
Cover not properly planed • Guard board bevel • Broken springs in suction pump
Hot stock causes trouble with vacuum • Uneven vacuum • Shove in a deckle
Jacket subject to many abuses • Jacket skids • Head in front of jacket breaks
Top roll jacket out of alignment • Bottom couch may develop cracks
Baby roll at couch coats over • Edge of sheet does not couch

clapboard, more being taken off one side than the other. A cover planed in this fashion will cause the paper to skip over, because it will let in air at intervals. Such a box could be run if the level extends the entire length; but, if not, the cover should be replaned, reground, or taken off and another cover substituted for it.

At other times, a cover will be planed thin on the sides and left high in the middle, another cause for skipping. This trouble can be remedied only by taking out the suction box and planing the cover again. Best results can be expected by leaving the middle 3/32 of an inch thicker than the edges.

Broken springs in a suction pump will cause a lot of vacuum, and, in case of such difficulty, the only solution is to install new springs.

Often there is an *uneven vacuum* with a rotary suction pump and vacuum tank combination. In a combination of this kind, the pump is installed to deprive the tank of air, not to handle suction water. Sometimes the suction water, which is supposed to follow certain piping to the basement, will change its regular direction of flow and rush up into the vacuum tank and finally into the pump, a circumstance caused by creating too much vacuum. By so doing, additional horsepower is thrown immediately upon the power unit, a situation which may disturb power conditions on the entire machine, especially when the power unit has been running at capacity.

The same disturbance will manifest itself in a single unit vacuum control system when too much vacuum is created in the drop legs. The increase in vacuum will bring about a change in flow direction of the suction water, again causing it to go over into the vacuum pump. So far as the author has observed, no glasses have been provided to permit a machine tender to know when such a disturbance is taking place without going into the basement.

Little attention is paid on a modern paper machine equipped with a suction couch to *positioning the suction heads* exactly on the edge of the sheet on the fourdrinier. However, on a less modern machine, where a jacket is run and the edge is not trimmed off at the wire, it is good practice to keep the suction heads exactly on the edge of the sheet. This location usually is the place where the jacket first bothers about couching. A wet edge also will crush and cause the paper to break on the first press.

If a *head is found in,* it should be adjusted properly at the first opportunity. It should be emphasized that any old time is not the right time. Most certainly, the time is not right if the situation involves the last (or next to the last) suction box and the reel, which is nearly up, already contains three tags. Wait until the reel is large enough to change before pulling on the head.

In pulling out a head of one of the last boxes, the machine tender should use his head. Due to the strong vacuum in such a box, the head must be jumped out. While performing this operation, the water in the box outside the head will fly into the air a foot or so. Sometimes it will break down the sheet at the presses.

Half of the running of a machine is planning. The machine tender should know what to do, and do it; but he should take no chances of putting breaks into the sheet if the winder is behind.

Suction box covers with holes which are too small cannot get the water out of the paper regardless of how much vacuum the pump creates. Large perforations are more efficient, if finger markings can be avoided.

If a *drop leg will not take hold,* the probability is that the suction box is getting air. This difficulty may be caused by a poor contact of the cover with the wire, or air may be getting in around the heads of the box. If the *cover is not planed properly,* the box should be taken out and the cover replaned. Sometimes the trouble can be overcome by stuffing the ends of the box with wet broke. The cause of the trouble is hard to determine when using a single control vacuum system. On the other hand, when using a separator system, air entering the leak can be heard rather readily.

If the leak is small, there will be some vacuum. In this case, the vacuum will pull up the piston in the drop leg controller and alternately close and open the valve, thus causing the controller to chatter. Seal the leak and the chattering will stop.

Hot stock may cause trouble with the vacuum in the suction boxes. The water in such stock, upon entering the suction boxes, gives up steam. The steam fills up space in the boxes which is necessary if atmospheric pressure on the top of the boxes is to drive the water through the covers. Under a condition of this kind, if a suction couch is being used, the wire is apt to slip because of insufficient vacuum within the couch, steam occupying the space that should be under partial vacuum.

A bottom couch may develop cracks after much metal has been turned off its face. These cracks cannot be noticed while a machine is running, yet they may cause a jacket to run badly or develop a slack edge in the wire.

The baby roll at the couch will coat over on some grades of paper and cause the sheet to be filled with holes. Do not attempt to eliminate the holes by taking out the roll and running without it. This roll holds the sheet down on the first felt, thus preventing air getting between the felt and the sheet. If air gets between the felt and the sheet in any volume it will cause a loss of suction in the first press roll. It also will cause the felt to mark.

The trouble can be corrected by running the roll backward. A little air kept on the roll and properly directed will turn it slowly in the desired direction.

If everything is normal about a set of couch rolls, the jacket, until quite old, should couch nearly as well on the edges as in the middle. A *jacket,* however, is *subject to many abuses* and is bound to cause trouble if not given proper care.

Where the couch is weighted evenly and the guard board chafes the jacket evenly, the jacket seam will run straight. Uneven weighting causes the seam to run behind on the side of greater weight. If this condition is quite pronounced, the lacing of the head will break and that end of the jacket will move in on the face of the top couch roll. Then the lacing will run on the wire.

Some authorities claim that the *jacket of a top roll out of alignment* pushes ahead faster on the side of the jacket that is being contacted earlier by the wire. This concept is incorrect since line pressure cannot be the same over the entire face of the bottom roll when top and bottom rolls are out of alignment. If this condition is pronounced, there would be no bearing at all on one end of the bottom roll. Therefore, how can the bottom roll

Stock piles up in front of guard board • Corrections in roll alignment
Damage to machine clothing • Screw works out of slice, spoiling wire
Dandy roll fills up • Save-all fills up • Pulling out heads
Stock may follow deckle strap • Planing suction box covers
Nozzle taken from pipe over wire • Sediment in dandy steam jet
Squirt cuts poor edge • Slices shake with table • White water return pipe plugs

shove the jacket ahead when there is no bearing in that place? The fact is that it does not. The jacket, being subject to more pressure on the end where line contact is made than elsewhere, slackens on that end. The seam, however, does not go behind on that side. It cannot because all of the pushing the entire jacket is getting is on this side. Rather, as the jacket slackens, it squashes off the end of the roll it covers and works over against the frame.

Should the head in the front side of the jacket break (or at least the lacings) and the jacket skid to the back side, leaving the front end of the top couch roll bare for one inch or so, the only thing to do is to shut down. Then take off the weights and levers; slacken the guard board; slacken the bolts that hold the front top couch box in place; with the adjusting screws, move the top couch roll on that side towards the dryers about one-quarter of an inch; and, finally start the wire. Upon starting the wire, the jacket will run back and cover the roll as it did before the lacing broke. At this time, stop the wire again; set the roll back in original position, being sure to tighten the bolts; put in new lacings; put back the weights and levers; start the wire; and then tighten the guard board.

The *skidding of a jacket* with the lacings in the head, as outlined, probably will ruin the edge of the wire, particularly if the wire is in full width. If such is the case, the wire will have to be trimmed. Sometimes paper will follow the jacket and pile up against the guard board. This trouble may be due to a slack edge in the wire. If the edge is slack, tightening the wire may help overcome the difficulty.

A machine tender operating a top couch should have a wool card for use in lightly scratching the edge of a jacket when the *edge of the sheet does not couch*. A wire brush may be used for the same purpose, but the card is preferable. Playing the pressure hose on the jacket ends during a break is a better way to overcome the trouble. This procedure will prove beneficial for a number of hours.

When *stock piles up in front of the guard board* and it cannot be gotten down with the pressure hose, the machine tender should push the squirt into the middle of the sheet and then climb upon the dandy board and with the ends of his fingers dig into the sheet on the wire between the suction boxes and the couch. Should the sheet not go down after following this procedure a couple of times, shut down and let the jacket run in clean water, at the same time playing the pressure hose on the jacket across its face.

The jacket should be washed with a few pails of hot soda ash water if the trouble is due to size.

Necessary *corrections in roll alignment* can be made with the use of instruments. The adjustment screws permit corrections to be made for the top roll. Seldom does the bottom roll get out of distance because of the dowels in the bottom boxes. The bottom roll, however, will get out of level if one of the shells in the boxes wear faster than does the other. Re-shelling the boxes on both sides takes care of this situation.

Upon coming on tour, the machine tender should report any *damage to machine clothing* which he may observe, simply as protection to himself. Likewise, in case of a thin jacket, he should station himself somewhere near it in order to be there and ready in case it gives out.

When it is necessary to *shove in a deckle*, the backtender should shove in all suction heads, except the last one, the desired distance for the change. Then, while the machine tender shoves in the deckle, the back tender should follow the edge of the sheet in with the head of the last box.

Some deckles cannot be shoved in. In individual cases of this kind, if the wire is not wide enough, another wire will have to be put on.

A machine tender should experience no trouble when *pulling out the heads* in press rolls, couch, and suction box (if running on first felt) for the purpose of widening out the sheet. However, a break in the sheet is apt to occur if he fails to wipe the ends of the paper rolls before widening the sheet. These rolls are wet enough beyond the edges of the unwidened sheet to cause the sheet, when widened, to stick to and wind around them, thus causing a break.

At times, *stock may follow the deckle strap* and coat it over for its entire length. The cause of this trouble is the lack of water on the deckle strap to wash off the stock. The correction is self-evident.

Should stock get under the deckle strap, look for a poor deckle, a poorly fitting deckle, a wire with a slack edge, or a breast roll out of distance. It may be due to any one or a combination of these things.

A *squirt may cut a poor edge* because of an old jet, the orifice of which has become large. The machine tender should wach for a condition of this kind and change the jet at his first opportunity.

If a *squirt plugs* and there is not an auxiliary unit to continue the cutting, the paper will have to be broke down and another nozzle installed. Where the water used for the squirt cannot be depended upon, the machine tender should keep a couple of nozzles handy at all times. He also should have a special wrench to permit making a nozzle change in a minimum of time.

In making a change, water should be allowed to run for a little while after the plugged fitting has been taken off and before installing the new fitting. The hose leading to the squirt should not be kinked. It usually is coated on the inside with slime, and kinking it would release some of the slime which might plug the new fitting.

If the *nozzle* being replaced has to be *taken from the pipe directly over the wire*, too much emphasis cannot be placed on the need for carefulness in doing the job.

With the older type of fourdrinier on which the *slices shake with the table*, there is the danger of a *screw working out of a slice and falling upon and spoiling the wire*. All screws in slices of this kind should be kept tight.

When the *save-all fills up* so that stock is getting near the wire and the machine tender cannot get the sheet over, the only thing he can do is to pull the slide and shut down.

Should the couch save-all plug or the machine tender fail to open the save-all in a break to let the stock run into the white water return pipe, the overflow pipe leading from the save-all to the filter tank may plug. If this pipe plugs, the return water from the seal tank cannot get to the filter and as a result will run out onto the machine room floor. If running a tray and vat system, this situation would not occur since the return water would not be disturbed.

The procedure to be followed in cleaning out a pipe line filled with stock naturally depends upon the individual layout and the equipment available for doing such a job.

Often *a dandy roll will fill up* easily. When a dandy performs in this way, it should be taken off and scoured with a solution of sulphuric acid and water.

If a dandy picks up everything that comes along, or if there are more breaks because of lumps than there should be, it is not a bad idea to take the dandy off and, with a wire brush, give it a good scrubbing with soda ash water. Often a machine will run better after such treatment of a dandy roll.

Sediment may accumulate *in a dandy steam jet*. This trouble is apt to occur particularly where steam showers are supplied with steam from the return line of the dryers.

EDITOR'S NOTE: This series of articles will continue in succeeding issues.

Formation Bottleneck Eliminated

R. G. SIMONTON

▶▶▶ THE MILL WITH WHICH the author is associated manufactures special kraft and rope products to meet unusual customer specifications. One of the more important steps entering into the process for making these papers is formation on the machine. So important is this step in meeting customers specifications that the temptation to operate at higher speeds has been avoided. Higher speeds invariably made our formation worse. It was definitely our limiting factor. Because of it, machine operation was considerably below drying capacity.

With the hope of eliminating this formation bottleneck, both as to quality and production, a new Pusey and Jones wet end was installed. This wet end, started up in February, 1941, consisted of three Goldsmith Stream-Flow Vat Systems with cylinder molds 48 in. diameter x 90 in. face.

Each of the new vats has an outer vat circle which serves as an approach pass before the making board, and a forming circle which is adjustable at front, bottom and back. They are of the direct flow type, the stock flowing in the same direction as cylinder rotation. The overflow from each vat, together with the white water drained through its mold, is delivered to an individual circulating pump, one pump for each vat.

Each pump is of the variable pitch impeller type and uses no valve. The quantity of flow is controlled by varying the pitch of impeller vanes by means of a handwheel.

From the pumps, the flow is directed upward in the inner cones of up-flow head boxes and from there to the Goldsmith flow-spreaders. The flow-spreaders consist of several streamlined passes and are set immediately under the vats. In spite of space limitations, this new equipment was installed in a very satisfactory manner.

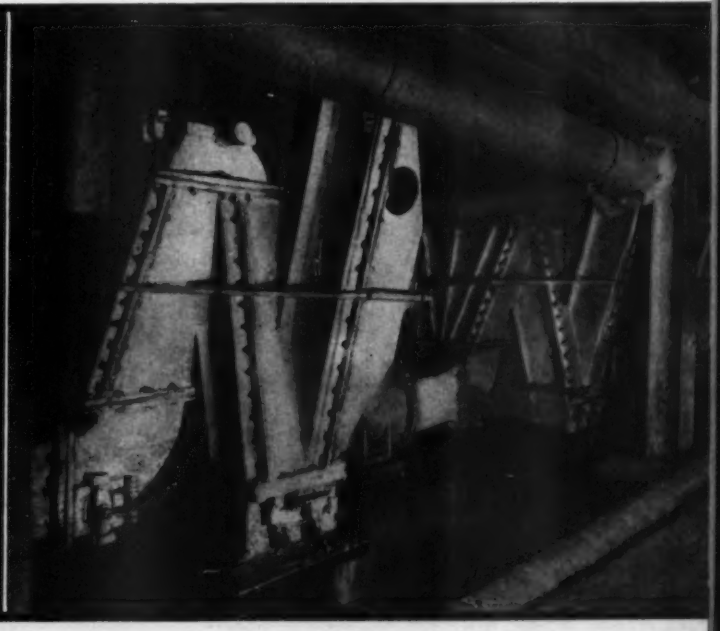
Among the outstanding features of the new wet end are the following:

The vat circles are quickly and easily adjustable to suit the stock and grade. The flow-spreaders produce a very quiet and even inlet flow. The flow-spreaders, up-flows and piping are rubber lined, making the vat systems corrosion-proof and easy to wash-up. The couch slices are of all-metal construction. Spill gates, circulating overflow and circle adjustments are operated from one side of the machine. This feature insures that everything remains square and eliminates the human factor in this respect. The whole construction is very rugged and simple.

From the first, formation on the machine was far superior to anything previously seen on these grades. The sheet is level. The tests are higher than previously with the same furnish. The mill is now operating at top drying and driving speeds, already resulting in production increases of from 20 to 30 per cent. Driving equipment to speed up the machine and a very considerable increase in dryer capacity will be installed shortly.

It is still too early to completely evaluate all the advantages of the new wet end. It is felt, however, that results have been shown which make it possible to serve customers better than in the past.

Left—Stream-flow vats. Right—Goldsmith flow-spreaders.



PAPER SKETCHES

IN ORDER TO STOP 8TH. CENTURY ARABS FROM MARKING MOHAMMEDAN MOTTOES ON PAPYRUS EXPORTED TO CHRISTIAN COUNTRIES, THE BYZANTINE EMPEROR THREATENED TO STAMP CHRISTIAN SIGNS ON GOLD COINS HE MADE FOR THE ARABS.
PAPER PRODUCTS
IN 1937 THE INVESTMENT PER WAGE EARNER IN THE PAPER, PULP, AND PRODUCTS INDUSTRY IN THE U.S. AMOUNTED TO $7,397, A SUM TOTALING 43% MORE THAN THE AVERAGE FOR ALL MANUFACTURING INDUSTRIES.
DURING THE 1911 WORLD SERIES IN PHILADELPHIA, A TON OF BLOTTING PAPER WAS USED TO DRY UP THE RAIN-SOAKED BASEBALL FIELD SO THAT GAMES BETWEEN THE NEW YORK GIANTS AND THE PHILADELPHIA ATHLETICS COULD GO ON.
Quilts OF PERFORATED PAPER SHEETS SEWN TOGETHER WERE POPULAR IN EUROPE IN THE 1800's.

HERE it is—your "cast-iron" answer to the splashing water and spattering liquids that make motor operation uncertain in many places. It gives you greater-than-ever protection in three important ways:

Extra Protection . . . against physical damage

One-piece cast-iron frame and end shields completely encase the motor, and offer formidable resistance to rust and corrosion. Ventilating openings are well baffled and contours of the motor shed direct-splashing water or liquids. The low-velocity air intake minimizes sucking in of the spray. Conduit box is waterproof.

Extra Protection ... against electrical breakdown

In the coil windings, the combination of Formex wire, a *special* synthetic-resin bond, and a tough external coat of Glyptal 1201 Red sets a new standard for resistance to moisture and to vapor in the air.

Extra Protection . . . against wear and tear

Completely enclosed ball bearings of high load-carrying capacity are standard. A cast-iron enclosure protects the bearing and its lubricant. A simple but effective seal along the shaft excludes liquids from the bearings.

In addition to these "extras," you get basic improvements in operating characteristics, convenience in installation, and clean-cut, compact design. Write today for Bulletin GEA-3595. Specify Tri-Clad on your next splashproof-motor order. General Electric, Schenectady, N. Y.

ASK ABOUT
TRI/CLAD
Splashproof MOTORS
Where wetness is a factor . . .
. . . and in some outdoor locations splashproof motors may be the answer. Ask your G-E representative about Tri-Clad splashproof motors.

GENERAL ELECTRIC

ALLIED

DU PONT WILL BUILD NEW NEOPRENE PLANT

A new neoprene synthetic rubber plant, which, when completed, will have a capacity output that will exceed the present total combined production of all synthetic rubbers, is to be built at Louisville, Kentucky, by the E. I. du Pont de Nemours & Company, Wilmington, Delaware. The capacity output of the new plant will be 10,000 long tons annually.

It was announced by officials of the company that the purpose of the new construction is to provide a supply of neoprene that will be adequate for all defense and commercial needs, including a substantial tonnage for the manufacture of certain types of heavy-duty tires. Neoprene is the only non-metallic substance on the Government's mandatory priority list and virtually all of the capacity of the present du Pont plant is being used for defense work.

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▶▶▶ H. C. BEAVER, president of the Worthington Pump and Machinery Corporation, Harrison, New Jersey, expressed his appreciation of the loyal and co-operative service of more than 2,800 employees who have completed five years or more service by awarding lapel labels. Close to 200 of the group were in the 25 to 29 year class—54 ranged from 30 to 39 years, and 11 have been with the company for more than 50 years.

◆

▶▶▶ THE EQUIPMENT, formulas, and manufacturing processes of the Western Adhesives Company in Chicago have been purchased by the Paisley Products, Inc., also in Chicago. Manufacturing will be transferred to the Paisley plant, which is now undergoing extensive alterations and expansion of storage, laboratory, and manufacturing facilities.

◆

NEW MARKETS OPENED FOR KRAFT PAPER

New and wider markets are being opened for bagging and wrapping material used in the packaging field by the development of a process for the waterproofing of common kraft paper. This waterproofing is being accomplished by the use of Pliolite, a moisture-vapor-proofing rubber derivative, developed by Goodyear Rubber & Tire Company, which has been used for several years on expensive papers.

The practicability of waterproof kraft paper has been demonstrated by extensive tests under various conditions before the formal announcement. Prior to this development, one of the greatest difficulties in the packaging of common bulk commodities was that the contents of the packages were not protected from high humidity conditions and the contents often become "caked."

The purpose of the Pliolite-coated kraft is to prevent the moisture from entering the bag, thereby keeping the contents in a factory-fresh condition. This bag may be heat-sealed to give a hermetically-sealed package. The Pliolite coating reduces the moisture-vapor transfer rate of the paper over one thousand fold and is the most efficient moisture-vapor-proof coating that Goodyear's laboratories have yet developed.

◆

▶▶▶ THE FOXBORO COMPANY, Foxboro, Massachusetts, recently moved the servicing department and offices to the newly constructed building located at 5151 Baum Blvd. in Pittsburgh. The building was erected especially for the company. It is entirely of masonry steel, and conforms to the best principles of modern design. It is air-conditioned and is equipped with fluorescent lighting with bays of glass blocks to take the place of windows.

◆

2ND ELECTRON MICROSCOPE NOW AT INSTITUTE

An electron microscope, capable of magnification up to 30,000 diameters and 100,000 diameters through further photographic enlargements, has recently been installed at the Institute of Paper Chemistry at Appleton, Wisconsin. Manufactured by RCA Research Laboratories in Camden, New Jersey, it is the second such instrument built by them. (cf. THE PAPER INDUSTRY AND PAPER WORLD, p. 1156, Feb. 1941.)

Optical microscopes are limited in their perception by the wave length of light itself but this new instrument goes beyond that sphere by employing beams of electrons for its definition of objects. An idea of the magnification possible is in the statement that a human hair could be enlarged to thirty broad under such circumstances. Although the device is very delicate the operation of it is unbelievably simple. It takes two men to operate it, however, one to prepare specimens and the other to observe and take photographs.

Rubber-lined welded tank cars have been placed on the approved list by the Interstate Commerce Commission. This illustration shows one of these new welded cars in which rubber linings are being placed at the plant of B. F. Goodrich Company, in Akron, Ohio. Many such cars are used by the chemical and allied industries.

Save your Dollars at many points.. with

LUNKENHEIMER
"KING-CLIP" Gate Valves

Dollar Saving Points

1 Coarse, heavy stuffing box thread withstands corrosion and stripping. Hexagon head gland loosens easily with wrench.

2 Stem thread bushing cast in bonnet—an original Lunkenheimer feature.

3 No clogging with these drain channels. They really drain the bonnet.

4 New type of bronze for stem provides exceptional resistance to thread wear.

5 Bronze seat rings rolled in. Bronze to bronze contact prevents corrosion.

Fig. 1640
150 lb. S. P.
225 lb. W. O. G.

Best known for its ruggedness, exceptional rigidity and ease of disassembly, the "King-clip" is built to do the rough jobs under conditions where valves must stand the gaff. Its unique design, however, and its availability with a number of trim materials give it extra advantages usually found only in valves made of more costly materials than iron.

Note the "Dollar Saving Points" in the "King-clip" design and construction — points which mean actual savings in your valve maintenance dollars through longer life and greater dependability.

Try the "King-clip" in the many places where small and medium size gate valves are used. Right after installation, the story of dollars saved begins to take form. And all through the days of their use, chapter after chapter testify to the money-saving essentials that are so carefully built into the "King-clip" to give you trouble-free and low-cost service.

• • •

Buy from your local Lunkenheimer distributor! He is cooperating in every way to give you the kind of service you so vitally need for the National Defense Program.

THE ORIGINAL "CLIP" VALVE WITH DRAIN CHANNELS AND BRONZE THREAD BUSHING IN BONNET.

ESTABLISHED 1862
THE LUNKENHEIMER CO.
"QUALITY"
CINCINNATI, OHIO, U. S. A.
NEW YORK CHICAGO
BOSTON PHILADELPHIA
EXPORT DEPT. 319-322 HUDSON ST., NEW YORK

Send for copy of Lunkenheimer Catalog No. 78.

LUNKENHEIMER

ASSOCIATIONS

ANN ARBOR LAYS EXTENSIVE PLANS FOR TAPPI MEETING

Groundwork for staging the annual fall meeting of the Technical Association of the Paper and Pulp Industry in Ann Arbor, Michigan, Sept. 16, 17, and 18 was laid at a meeting of TAPPI representatives and University of Michigan officials in Ann Arbor May 15. The university will co-operate to the fullest in accommodating the 1,000 or more TAPPI visitors.

Ralph A. Hayward, president of the Kalamazoo Vegetable Parchment Company, is general chairman, assisted by his "lieutenant," Vice Chairman W. K. Kidder, of the Bryant Paper Company, Kalamazoo. The program committee is comprised of four Kalamazoo men, Fred Shankweiler of the Hercules Powder Company, W. A. Kirkpatrick of the Allied Paper Mills, Fred Chappell of the Sutherland Paper Company and Mr. Kidder; Myron Kin of the Dow Chemical Products Company, Midland, Michigan, and D. W. McCready, professor of chemical engineering at the University of Michigan. Harry D. Eliason of Kalamazoo, western representative of the Cellulose Sales Company, New York, is chairman of the women's activities committee.

Representing the University at the May 15 meeting were Dr. C. A. Fisher, director of the university extension service, and Prof. A. H. White, head of the department of chemical engineering.

It is expected that a number of TAPPI members will visit Kalamazoo mills on Sept. 15. Although the meeting officially will close Sept. 18, a trip to Greenfield Village in Dearborn and to points of interest in Detroit is planned for the following day.

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SPRING MEETING N. W. DIVISION SUPTS. ASS'N

The two-day spring meeting of the Northwestern Division of the American Pulp and Paper Mill Superintendents Association held at Marinette, Wisconsin, May 23-24, was outstanding, both from the standpoint of attendance, and because of the many fine features presented at the sessions.

The schedule of events included a number of fine entertainment features, also mill visits, and at the business sessions a number of exceptionally instructive and valuable papers were presented. C. T. Ramsden, of Beloit Iron Works, Beloit, Wisconsin, addressed the meeting on the subject of reels. He used slides and photographs to illustrate different types of reels. H. A. Schmitz and H. Zerbe, of the A. O. Smith Corporation, Milwaukee, spoke on the design and construction of welded pressure vessels. "How Savings Pay for Instrument Control," was the subject discussed by A. H. Stanton, of the Mason-Neilan Regulator Company. I. W. Johnston, of the Dorr Company, had prepared a paper on the water treatment plant at Escanaba Paper Company, which was read by A. H. Vallez, of Dorr Company.

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NAT. PAPERBOARD ASSOCIATION HAS SPRING MEETING

The spring meeting of the National Paperboard Association was held at The Homestead, in Hot Springs, Virginia, May 15 and 16. The most important topic discussed at the meeting was the National Defense Program. Charles E. Nelson, association president, and many others stressed the importance of taking care of the Government's requirements properly and promptly. At the opening of the meeting, President Nelson paid a tribute to the memory of Colonel H. W. Ellerson, a past president of the association, and appointed Alexander Calder and Sidney Frohman members of a committee to draft and submit resolutions expressing the sympaathy of the members.

In his report to the association, President Nelson covered the following subjects: membership, finances, and problems confronting the paperboard industry. Other subjects considered at the sessions included: The Statistical Yearbook, presented by Grafton Whiting; Maple Leaf blankets; a report by Malcolm K. Whyte, counsel; report on timely labor topics by Finley F. Bell; and a report on paperboard and paperboard products in the defense program by Albert W. Luhrs.

Joseph S. Miller, chairman of the Eastern Boxboard Group, reported on the activities of the group, announcing that they had held meetings in New York every other week during the past year, and that the attendance had been excellent. It was also stated that these meetings were keeping members informed on developments within the industry and those affecting the industry.

W. I. Osborne, in his report for the Western Boxboard Group, pledged this body's full co-operation and called for 100 per cent co-operation from all other members in connection with making prompt deliveries necessary for the National Defense Program.

R. H. Bursch, spokesman for the Container-Board Group, agreed with the suggestions presented and added that the association as a body had proved to be a vehicle of the greatest value in presenting industry matters in conference with government officials.

In reviewing the activities of the Maple Leaf committee, Alan G. Goldsmith paid tribute to the industry for their generosity in sending blankets overseas. He stated that up to May 15, 1941 a total of 26,203 blankets had been contributed and shipped.

◆

JOINT SPRING MEET OF THREE DIVISIONS

A gathering at Niagara Falls, Ontario, on May 16 and 17 brought together three prominent divisional meetings of associations in one large joint spring conclave. This event combined the meetings of the New York-Canadian Division of Superintendents Association, the Empire State Section of TAPPI, and the Niagara Technical Section of the Canadian Association.

High-lighting the many special events on the program were visits to a number of well-known paper mills. Technical addresses were made at the sessions by Dr. H. Stanley Bristol, technical director, International Paper Company, Niagara Falls, New York; and R. de Montigny, research associate of the Pulp and Paper Research Institute of Canada. W. H. Roberts, Jr., of Hooker Electrochemical Company, Niagara Falls, New York, spoke on the production and use of unsettled bleach liquor.

There were several earnest discussions and the Empire State Section elected the following new officers: Chairman—H. D. Cook, Sweet Brothers Manufacturing Company, Phoenix, New York; vice chairman—Vance P. Edwardes, International Paper Company, Palmer, New York; secretary-treasurer—Fred O'Neil, New York State College of Forestry, Syracuse.

CONVENTIONS AND COMING EVENTS

June 17-19—American Pulp and Paper Mill Superintendents Association, Poland Spring House, Poland Spring, Maine.

June 23-27 — Forty-fifth annual meeting American Society for Testing Materials, at the Palmer House, Chicago.

Sept. 16-20—Fall meeting of the Technical Association of the Pulp and Paper Industry, University of Michigan, Ann Arbor, Mich.

Sept. 17-19—Annual Conference of National Industrial Advertisers Association, Royal York Hotel, Toronto.

Oct. 6-10—Thirtieth Annual Safety Congress of the National Safety Council, Stevens Hotel, Chicago.

Jan. 26-30, 1942—Seventh International Heating and Ventilating Exposition, in the Commercial Museum, Philadelphia.

◆

N. I. A. A. PLANS MEETING IN CANADA

Plans for the first National Industrial Advertisers Association annual conference to be held in Canada are rapidly taking form. It was announced that the important matter of how to use advertising with the greatest effect under the changing conditions now, and in the future, will be discussed thoroughly. Sixteen clinics will provide a wide choice of subject matter, and members will also have an opportunity to have questions answered by top ranking industrial advertising men, a special session is being arranged.

It was also stated that travel to and from Canada is an easy matter, devoid of formality, and that U. S. dollars command a premium in Canada. The conference will be held September 17-19 at the Royal York Hotel, Toronto, one of the finest convention hotels on the continent.

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NEWSPAPER MEN TO VISIT KEY DEFENSE CENTERS

A group of newspaper correspondents, who have just returned from war-torn Europe and reported on activities over there, are being furnished airplane transportation for a 12-day tour of key defense centers of the nation by the National Association of Manufacturers. The tour, which started from New York on June 3, has received the authority of the War and Navy Departments, and the Army and Navy Departments have co-operated in furnishing passes to visit plants heretofore closed to newspapermen, newsreel cameramen, and magazine writers.

● Acme strap-applying equipment includes automatically seal-fed tools which tension, seal and cut the strap in two easy operations.

● The Acme Vertical Anchor method of bracing involves the use of anchor plates nailed to the car floor. Flat steel bands are extended vertically around the front of the "gate" and sealed.

● Chafing in transit, a source of costly paper damage, is eliminated by the Acme Skid-Check Method. This scientific method has proved its cost-reducing advantages in the industry.

● This car of skidded paper discs is braced with Acme Steelstrap. Replacing out-moded stowing methods, dunnage was reduced by 600 pounds and unloading time was cut down by 80%.

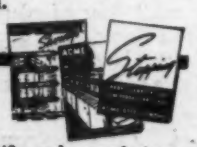
Doc. *Steelstrap* Works For Every Branch of the Industry

IN the shipping department of many paper manufacturers . . . Acme Steelstrap is making paper shipments faster, safer and more economically. Working in close coordination with paper men, Acme has devised bracing procedures for all kinds of paper shipments—in cases, rolls or on skids.

Through the use of Acme Processes, shipping damage has been reduced to a minimum . . . with a corresponding decrease in claims and annoyances. Consequently, customer goodwill has been protected. Increased shipping room output and lower costs too, have resulted from scientifically applied Acme Steelstrap.

Write today for full information on these tested and approved Acme Processes for preparing paper for safe arrival. There is no obligation —mail the coupon.

ACME STEEL COMPANY
2851 ARCHER AVENUE
CHICAGO, ILLINOIS
Branches and Sales Offices in Principal Cities



Acme Steel Company,
2851 Archer Avenue,
Chicago, Illinois.
☐ Send me full information on the scientific and proved Acme Bracing Procedure.
Name.....
Address.....
City.....State.....

S A F E T Y

FOX RIVER VALLEY SAFETY CONFERENCE

Nearly 2,000 safety workers from paper and pulp mills in Wisconsin attended the Fox River Valley and Lake Shore Safety Conference at Fond du Lac, Wisconsin, on May 22. The meetings of the Pulp and Paper Section of this body are always very helpful and well attended, and this year was no exception. At the afternoon session, presided over by L. C. Smith, personnel director of Thilmany Pulp and Paper Company, Kaukauna, Wisconsin, and H. F. Hackworthy, of the Combined Locks Paper Company, Combined Locks, Wisconsin, L. J. Barrette, of the Consolidated Water Power and Paper Company, Wisconsin Rapids, Wisconsin, gave a most instructive address in which he outlined the safety work carried on by his company's mills.

Speakers at the Paper Products and Finishing Departments sectional meeting were C. E. Wellnitz of Chicago, and George E. Burns, well-known member of the Chicago staff of the National Safety Council. J. A. Long, of Bay West Paper Company, Green Bay, and H. D. Purdy, of Tuttle Press Company, Appleton, were co-chairmen of this session.

The climax of the meeting was the banquet which closed the conference and drew a record attendance of approximately 1,000 guests. Allan A. Stockdale, of the National Manufacturers Association, was the guest speaker at the banquet, and his subject "What Is the American Way?" was highly inspirational.

Manitowoc will be host to the conference in 1942.

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▶▶▶ ADDRESSING the convention of the National Fire Protection Association which convened in Toronto, May 15 to 17, David P. Goodwin of the Forest Service of the U. S. Department of Agriculture, warned the gathering that forest fires undoubtedly will be started as a part of any sabotage movements and the forests of the continent are vulnerable to air attacks.

He stated that in dry, windy times, a small fleet of planes, loaded with small incendiary bombs could start thousands of fast-running fires in a single night in one or a dozen states.

◆

▶▶▶ AT A DINNER MEETING of executives and foremen of the Rolland Paper Company, Mont Rolland, Quebec, held at the St. Jerome Golf Club recently, the trophy for Class A mills in the Safest Mills in Canada Contest was presented to this company. The presentation was made by J. N. Stephenson, editor of *The Pulp and Paper Magazine of Canada,* sponsors of the contest. The trophy was received on behalf of the mill by Miss Jeannaux, plant nurse, and Assistant Superintendent George Blanchard responded to Mr. Stephenson's address.

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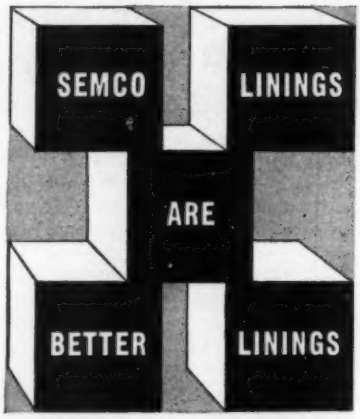
NSC 1940 ACCIDENT EXPERIENCE REPORT

Lost-time accidents in the paper and pulp industry during 1940, based on reports to the National Safety Council from 246 mills whose employees worked 230,583,000 man-hours, increased Frequency over the previous year by 6 per cent, and decreased Severity 2 per cent.

The Frequency Rate of 15.38 was 23 per cent above the average for all industries in 1940. The Severity Rate of 1.64 was 14 per cent higher than the all-industries rate. Paper and pulp mills ranked 21st in Frequency and 23rd in Severity in a list of 30 major industries.



STEBBINS *Linings* and STEBBINS *Service*

Offer a dependable source of supply for all acid and corrosion resistant lining requirements.

Let Stebbins do the job under a lump sum contract — backed by an unqualified guarantee of satisfaction.

SEMCO

STEBBINS ENGINEERING & MANUFACTURING CO.

Eastern Blvd. Watertown, N. Y.

The Paper Industry Safety Scores

July 1, 1940 to June 30, 1941

Out of 183 mills reporting for April, 12 have perfect record

PERFECT SCORES
Division I—Pulp and Paper Mills

PARTICIPANT	MILL	LOCATION
GROUP A		
GROUP B		
GROUP C		
Price Brothers & Co., Ltd.	Jonquiere, P. Q.	Canada
GROUP D		
The Mead Corporation	The Harriman Co.	Harriman, Tenn.
Bird and Son, Inc.	Phillipsdale	Rhode Island
United States Gypsum Co.	North Kansas City	Missouri
The Mead Corporation	Nashville	Tennessee
Spaulding Fibre Co., Inc.	Milton	New Hampshire
Central Fibre Products Co.	Vincennes	Indiana
Alton Box Board Co.	Carlyle	Illinois
Spaulding Fibre Co., Inc.	Hayes	New Hampshire

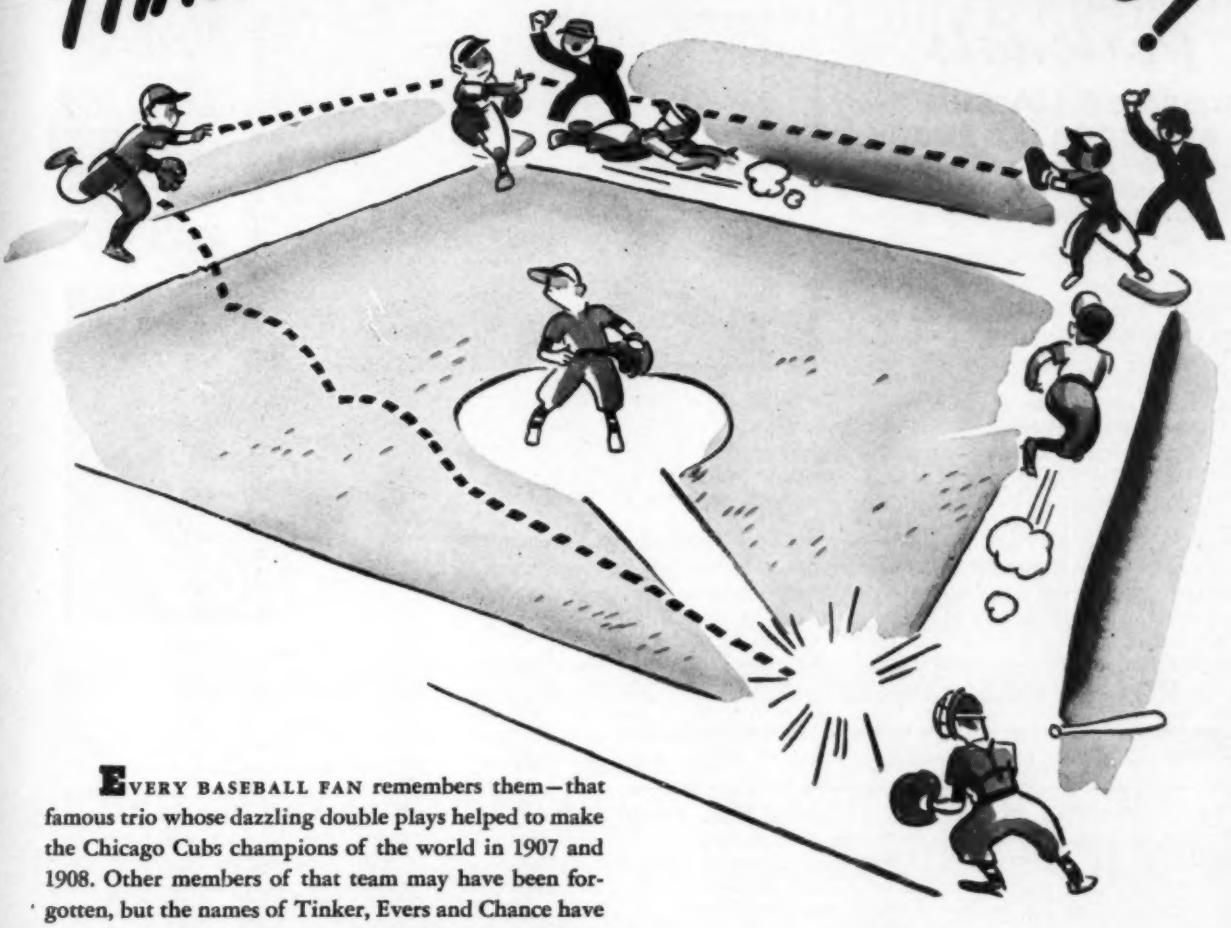
Division II—Paper and Board Re-Manufacturing

Bird and Son, Inc.	Chicago	Illinois
Bird and Son, Inc.	Shreveport	Louisiana
Bay West Paper Co.	Green Bay	Wisconsin

SUMMARY OF CONTEST EXPERIENCE

Division	Man-Hours Worked	Reportable Injuries	Frequency Rate 1940-41 (10 mos.)	Comparison of Rates with 9 mos. of 1940
All Divisions	150,386,469	2,073	13.78	− 4%
Paper & Pulp	135,922,045	1,901	13.99	− 4%
Group A	90,009,337	1,084	12.04	+ 1%
Group B	24,787,439	381	15.37	−15%
Group C	13,991,360	279	19.94	−13%
Group D	7,133,909	157	22.01	+ 1%
Paper & Board Re-Manufacturing	14,464,424	172	11.89	+ 2%

Tinker-to Evers-to Chance!



EVERY BASEBALL FAN remembers them—that famous trio whose dazzling double plays helped to make the Chicago Cubs champions of the world in 1907 and 1908. Other members of that team may have been forgotten, but the names of Tinker, Evers and Chance have come down through the years. Why? Because of their unbeatable teamwork, their all-round infield efficiency.

Making good felts is a lot like playing winning baseball—it requires *teamwork,* the close cooperation of individual experts to produce the best results. F. C. Huyck & Sons have developed a perfection of teamwork that has been solving papermakers' problems for 70 years. Huyck field engineers initiate the play with facts, workers in the Huyck research laboratory develop the formula, and Huyck craftsmen produce the felts that meet the requirements of each particular paper problem. Even then the job isn't done, for Huyck continues to check the performance of felts in actual operation—constantly works to help make better paper at lower costs.

Are *you* using all the facilities of this organization—the world's largest makers of papermakers' felts? The services of our field engineers in helping to solve your problems are available to you free on request.

KENWOOD WOOL PRODUCTS

F. C. HUYCK & SONS

ESTABLISHED 1870

KENWOOD FELTS • ALBANY, N. Y.

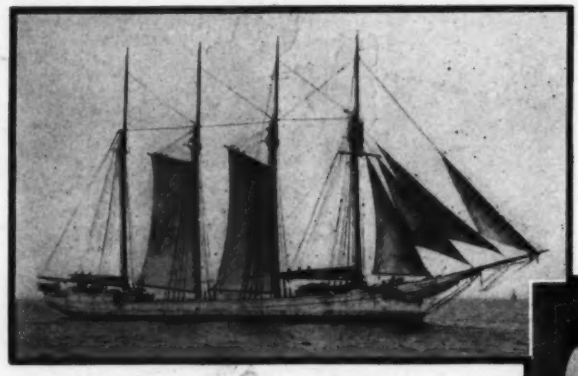
NAMES *in the* NEWS

Personals

SLOAN FELLOWSHIP AWARDED C-Z ENGR.

One of the eleven outstanding young business men to be awarded the coveted Alfred P. Sloan Fellowship was Roy H. Miller, shop supervisor for the Camas division of Crown Zellerbach Corporation, Camas, Washington. The fellowship consists of an intensive one-year co-operative program of executive development in business administration and economics at the Massachusetts Institute of Technology. This announcement was made by Professor Wyman P. Fiske, director of the fellowship program.

This recent appointment is another step forward for the young man, who as a boy studied the fundamentals of arithmetic in the cabin of a sailing schooner, and used maritime charts and short visits ashore to give him a background in geography. At the age of five, Roy Miller lost both of his parents and was adopted by an uncle and aunt. The uncle's schooner, the four-masted "Robert H. Hind", was Miller's school and home, excepting for brief intervals ashore. Later his uncle was transferred to another schooner, the "Bainbridge", and it was on these two vessels that the boy made his home until he was sixteen years old.



Below — Roy Miller, who has just won the coveted Sloan fellowship.

Left—His uncle's schooner, which was home to Roy as a boy. It was here that he studied arithmetic and learned geography from maritime charts.

In 1929, Miller entered the Washington State College at Pullman, Washington, and working at various odd jobs, earned his entire college expenses, graduating in 1933 with a degree in mechanical engineering. For three years following his graduation, he worked as a machinist for the Charles R. McCormick Lumber Company at Port Ludlow, and then was employed in the engineering department of the Crown Zellerbach Corporation at the Crown Willamette mill. Shortly afterward, he enrolled in the Camas Paper School and completed a four-year course in three years.

At the ceremony for the awarding of the fellowship, Professor Fiske announced that the event had taken on special significance this year. He elaborated by saying, that it is evident from the willingness of industry to release men for the particular objective of additional training to meet the complex national problems raised by defense activities.

◆

▶▶▶ *R. B. Nichols,* secretary of the Bantam Bearings Corporation, South Bend, Indiana, since 1939, was recently elected vice president and general manager. He is to succeed A. H. Frauenthal, who formerly held this position (cf. THE PAPER INDUSTRY AND PAPER WORLD, p. 156, May, 1941). Mr. Nichols has been associated with the company for 17 years, during which time he has risen from the ranks to his present position. Another member of the Bantam Corporation, *J. Frank Oehlhoffen,* who has been assistant sales manager, has been promoted to sales manager.

R. B. Nichols

J. F. Oehlhoffen

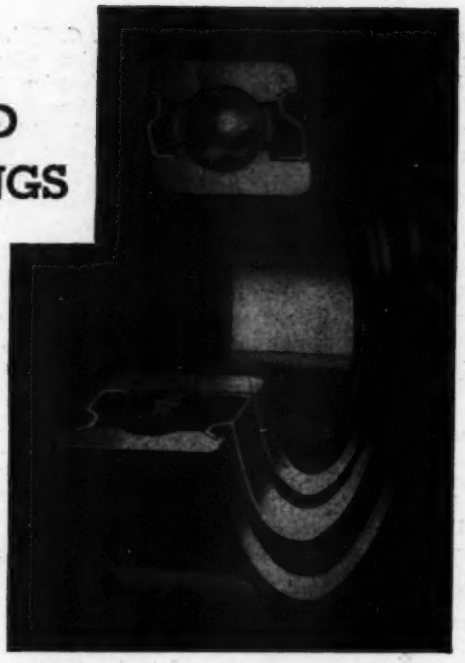
◆

▶▶▶ A recent announcement states that the Armstrong Cork Company, Lancaster, Pennsylvania, has expanded the function of the advertising department to include all promotional activity. *M. J. Warnock* has been appointed as director of advertising and promotion with *E. Cameron Hawley* as assistant.

◆

▶▶▶ *J. M. Howell,* former assistant manager of the Schenectady (New York) works of the General Electric Company, recently was appointed manager to succeed *E. D. Spicer,* who has been advanced to the position of assistant vice president in charge of manufacturing. Mr. Howell has been associated with the company for 40 years and Mr. Spicer has been with the organization for 17 years.

SELF-SEALED BEARINGS



"9000-DD", with Double Metal Seals, here shown; also made as "9000-D" with Single Metal Shield.

"NORMA-HOFFMANN"
PRECISION BEARINGS
BALL, ROLLER AND THRUST

LARGER GREASE CAPACITY NO SEAL DRAG

IN "9000" SERIES (Feltless)

Interchangeable in dimensions with felt seal bearings.

Employs simplified, inwardly extending, flanged metal shields which do not rotate and cannot "foul" other rotating seal parts.

Seals are highly efficient in retaining grease in either horizontal or vertical position.

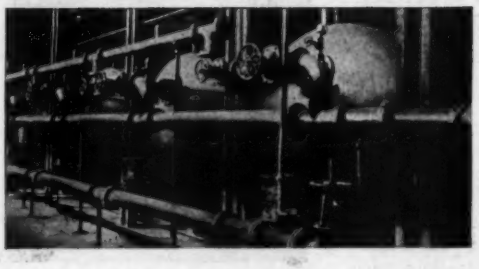
Simple seal occupies less space within bearing than felt seal, PROVIDING GREATER GREASE CAPACITY AND A MORE LASTING LUBRICANT SUPPLY.

Metal seals, though close fitting, clear recess on inner ring, ELIMINATING "DRAG" OR FRICTIONAL RESISTANCE and power loss, and providing higher starting speeds and increased efficiency. Seals cannot wear and are permanently effective.

Totally sealed against foreign matter, providing absolute cleanliness at all times.

NORMA-HOFFMANN BEARINGS CORPORATION, STAMFORD, CONN., U.S.A.

For "All-out" Production You Will Need These Dependable NORWOOD FILTERS



You can get greater production of a better sheet with Norwood Filters, for they give you cleaner process water and help prevent shut-downs and break-downs.

Investigate . . . Send for these Technical Bulletins

- ☐ FG-2 Norwood Gravity Filters
- ☐ FP-3 Norwood Steel Pressure Filters
- ☐ F-21 Strainers and Manifold Systems
- ☐ F-25 Mixing Tank Agitators
- ☐ F-26 Water Level Controllers
- ☐ F-28 Coagulating Tanks, Basins
- ☐ F-30 Chemical Feeding Equipment
- ☐ F-32 Separate Air Wash System
- ☐ F-33 Air System for Mixing Tanks
- ☐ F-53 Filter Sand and Gravel

Check the bulletins you desire, write your name and address in the margin, and mail.

THE NORWOOD ENGINEERING CO.
16 No. Maple St., Florence, Mass.

A GOOD START AND A GOOD FINISH WITH
NORWOOD
DEPENDABLE WATER FILTERS AND PAPER FINISHING MACHINERY

JAMES COOMBE NEW PRES. OF WM. POWELL CO.

At a recent election James Coombe was elected president of The Wm. Powell Company, Cincinnati, Ohio. He has been associated with the company since 1910, with the exception of two and one-half years, which time he spent

James Coombe

as captain of the artillery in the first world war. Mr. Coombe is also a director of the First National Bank, the Crosley Corporation, the Globe-Wernicke Company, and the Randall Corporation.

Other officers elected are: Harry H. Coombe, chairman of the board and treasurer; George E. Weitkamp, first vice president and secretary; David M. Forker, Oliver F. Gang, William E. Heilig, and E. R. Noll, vice presidents; and William E. Minor, Jr., assistant to the president.

◆

WILLIS CARRIER AWARDED FRANK P. BROWN MEDAL

The Frank P. Brown medal was awarded for the first time for improvements in the building and allied industries by the Franklin Institute to Dr. Willis H. Carrier for his work as "a pioneer in the creation and development of the science of air conditioning." The presentation was made by Philip C. Staples, president of the Franklin Institute and the Bell Telephone Company, Pennsylvania, at the annual Medal Day exercises of the Institute in Philadelphia.

Dr. Carrier, who is chairman of the Board of Carrier Corporation, graduated from Cornell University in 1901 and accepted as one of his first jobs the solving of problems of control of temperature and humidity. It was during this period that he began his experiments on air conditioning which resulted in his Rational Psychrometric Formulæ in 1911. In 1915 he founded the Carrier Corporation in Newark, New Jersey.

Among the many awards that he has received for his scientific achievements are the John Scott Medal, given him in 1931 for the invention of processes and apparatus for air conditioning and refrigeration; the F. Paul Anderson Gold Medal in 1932, for his scientific achievements in the field of heating, ventilating, and air conditioning; in 1934 he was awarded the medal of the American Society of Mechanical Engineers; and in 1935, Lehigh University conferred on him a Doctor of Engineering; and last year he was selected as a Modern Pioneer of Industry by the National Association of Manufacturers.

◆

HUGH M. SUTTON IS AGAIN WITH BAGLEY & SEWALL

The Bagley & Sewall Company, Watertown, New York, announces that Hugh M. Sutton, who was formerly connected with that organization, has again become connected with the company as sales engineer.

Mr. Sutton was with the Bagley & Sewall Company from August, 1930, until December, 1938, when he resigned to go with the Hudson-Sharp Machine Company. He will now devote his time to traveling through the New England territory, the states of New Jersey, Pennsylvania, and the southern part of New York.

◆

R. COOPER MADE SUP'T OF POWELL RIVER MILLS

The new superintendent of mills for the Powell River Company in Powell River, British Columbia, is Russel M. Cooper. He succeeds Grant M. Fowler, who passed away recently.

Mr. Cooper was formerly associated with the Quebec-North Shore Company, Baie Comeau, British Columbia. He entered the paper and pulp industry after the first world war as a pulp tester at the Grand Mere mills of the Laurentid Company. In 1936 he became general paper mill superintendent, after working at the Port Arthur mills as superintendent. Later he joined the Ontario Paper Company and was general superintendent of the mill at Baie Comeau when it opened.

▶▶▶ *W. C. Pinkerton,* former assistant technical editor of the *Chemical Engineering Catalogue,* recently resigned his position to join the Monel and Rolled Nickel Advertising Department of the International Nickel Company, New York City. Mr. Pinkerton is considered a specialist in handling of technical material for the process industries and he will be engaged in the editing of house publications devoted to those industries.

◆

▶▶▶ *Dr. G. L. Cunningham* was recently appointed manager of the technical service department of the Pittsburgh Plate Glass Company, Columbia Chemical Division. Dr. Cunningham joined the company in September of last year after having served as research chemist at the Mathieson Alkali Works since 1930.

◆

▶▶▶ *Dwight L. Monaco* has joined the sales organization of the International Printing Ink Division of the Interchemical Corporation, and will be located in the New York offices. Mr. Monaco was formerly associated with the printing division of the Kalamazoo Vegetable Parchment Company, Kalamazoo, Michigan.

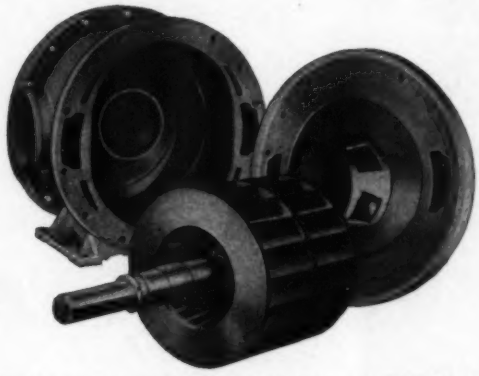
◆

▶▶▶ A newly created industrial relations department has recently been established by the Allis-Chalmers Manufacturing Company, Milwaukee, Wisconsin, with the aim of putting into practice a far reaching plan to

L. H. Hill

promote a more cordial relationship between employees and management. *Lee H. Hill,* who was elected vice president of the organization at the recent meeting of the board, will have charge of the new department.

SIMPLICITY



NASH VACUUM PUMPS HAVE ONE MOVING PART

Operating advantages made possible by the Nash principle, and present in no other type of vacuum pump, permit a new level of operating economy. Nash Vacuum Pumps have but one moving part, a rotor cast in one piece, and revolving without metallic contact. There are no valves, no pistons or sliding vanes, no internal parts requiring wear adjustment or lubrication.

NASH ENGINEERING COMPANY
SOUTH NORWALK, CONNECTICUT, U. S. A.

WHAT WE MEAN BY *Efficiency*

Efficiency at Lindsay consists only secondarily in turning out a definite number of Fourdrinier wires in a given number of hours. It consists primarily in making every one of those wires comply with rigid policies. And those policies have been tightening year after year, since 1903.

THE LINDSAY WIRE WEAVING CO.
Serving the Paper Industry Since 1903
14001-14299 Aspinwall Ave., Cleveland, O.

Lindsay WIRES
FOR PAPER MILLS

Problem:

Ways and Means to Cut Chipper Knife Grinding and Power Cost.

Solution:

Heppenstall E.I.S. Alloy Steel Knives

If you could solve all your mill problems as easy as Heppenstall E.I.S. Alloy Steel Knives can solve your pulp-wood chipping problems, the all-important job of operating a paper mill would be greatly simplified.

Back of every Heppenstall E.I.S. Alloy Steel Knife is a guarantee that they will show a unit cost below that of any other chipper knives on the market. The main reason for the guarantee is that we make our own steel, which is a patented analysis containing a balanced quality of carbon, chrome, molybdenum and vanadium. Another item of importance is that the amount that can be removed from the width in regrinding is increased 20%. They make less sawdust and will retain the same keen cutting edge after from 40 to 50 re-grinds.

Let Heppenstall E.I.S. Alloy Steel Knives solve your pulp-wood chipping problems. They will save you real money. Order a set today. Write for full information—no obligation.

HEPPENSTALL COMPANY
PITTSBURGH · DETROIT · BRIDGEPORT

HEPPENSTALL QUALITY
Heppenstall has the experience

Guaranteed
To show a unit cost below that of any other chipper knives on the market.

▶▶▶ Announcement has been made of the appointment of *Hubert H. Henderson* as treasurer and credit manager, and of *Henry C. Noseworthy* as Secretary of Fraser Companies, Limited, and subsidiary companies. Mr. Henderson, who became associated with the company in 1919, has been assistant treasurer and credit manager of the company and subsidiaries since 1930. Mr. Noseworthy joined the company in 1933, and later in that year was appointed assistant secretary, which position he held until his recent promotion.

◆

BURWELL AWARDED SCHOELLKOPF MEDAL

In recognition of "his work in producing and utilizing fatty acids, lactones and other chemicals from petroleum"; which has proved beneficial to paper manufacturers as well as numerous other industries, Dr. Arthur W. Burwell, technical director of the Alox Corporation, Niagara Falls, New York, has been awarded the Jacob F. Schoellkopf Gold Medal of the Western New York Section of the American Chemical Society, it was announced recently by Nelson Allen, secretary of the section.

Dr. Burwell, according to the society, was also the first to demonstrate the practicability of the Dow process for obtaining bromine, and has done much to further the use of microphotography and electro-chemistry as applied to metallurgy. Since 1926 he has worked exclusively with the Alox process, which involves oxidation of petroleum by air under the influence of heat, pressure, and catalysts.

Dr. Burwell is the eleventh scientist to receive the award, founded in 1931 by Jacob F. Schoellkopf, industrialist and financier, and a member of a pioneer Buffalo family. The presentation was made at the section's meeting May 20 in Niagara Falls.

◆

▶▶▶ A record of 63 years of service with the same organization was terminated May 27 when *Thomas R. Humeston* resigned his position with the American Writing Paper Corporation. Mr. Humeston left high school to enter the Holyoke Paper Company as office boy. In 1893, when this company was absorbed by the American Writing Paper Company, Inc., he remained with the company and its successor, the present American Writing Paper Corporation, ever since. He advanced steadily until he became office manager, which position he held until 1927, at which time he joined the sales staff; for the past 14 years he has been in the general office.

CRANE MAKES COLLIER PRES., AND RUMELY V. P.

The Crane Company, Chicago, announces that John H. Collier has been elected president of the company to fill the vacancy left by the late Charles

John H. Collier

B. Nolte (cf. THE PAPER INDUSTRY AND PAPER WORLD, p. 170, May, 1941). V. P. Rumely was elected vice president in charge of manufacturing to succeed Mr. Collier.

Mr. Collier joined the Crane Company immediately following his graduation from Purdue University in

V. P. Rumely

1903. From his original position as core maker's helper, he has progressed through a variety of positions giving him a well-rounded background of the company's activities. In 1929, he was engaged in foreign interests of the company, acting as president of the Cie Crane in Paris, and chairman of the Crane Ltd. in London, returning to the United States in 1933.

Mr. Rumely has been works manager of the company for the past four years, during which time he has been closely associated with Mr. Collier. Graduating from the University of Wisconsin in 1912, his first job was with his grandfather's farm implement plant in La Porte, Indiana. Later he became associated with the Hudson Motor Company shops, where he progressed through all the stages of production management until he became factory manager. He resigned this position in 1937 to join the Crane Company.

◆

▶▶▶ At a recent election of the Board of Directors of the B. F. Goodrich Company, Chicago, *George T. Kilmon* was elected assistant secretary and *Edward M. Martin* was elected assistant treasurer. Mr. Kilmon will succeed J. L. McKnight, who recently passed away. He will have complete charge of the company's law department. Mr. Martin has spent the last ten years, until his return a month ago, as a foreign representative of the company.

◆

HERCULES PROMOTES THREE OFFICIALS

Continuing the policy of the Hercules Powder Company, Wilmington, Delaware, of placing the management in the hands of the working directorate, the Board of Directors recently elected Petrus W. Meyeringh as vice president and member of the company's Executive Committee. Albert E. Forster, general manager of Naval Stores Department, and Luke H. Sperry, chief engineer of the company, were also elected directors of the company.

Mr. Meyeringh, elected a director in 1937, has been the head of the company's Export Department since 1930. Previous to that time, he served as agent for the resale of naval stores and cellulose products in Europe.

Mr. Forster, after receiving his engineering degree at Stanford University in 1925, immediately started working for Hercules Powder Company in the San Francisco office of the company's Explosives Department.

In 1913, Mr. Sperry joined the company as resident engineer of the Hercules, California, explosives plant, and in 1918 he was promoted to assistant superintendent. At present, he has complete charge of the expansion in plant capacities necessitated by defense demands for the company's various industrial chemicals.

RHODES SCHOLARSHIP GOES TO McGILL MAN

Donald B. W. Robinson, Moncton, is New Brunswick's 1941 Rhodes Scholar. The selection committee chose Mr. Robinson over four other applicants, two from Saint John and two from Fredericton.

In announcing the committee's choice it was also stated that although Rhodes Scholars from Canada were not attending Oxford University at present because of the war, there was a possibility that an exception might be made in the present instance. Mr. Robinson is engaged in chemical research at McGill University, working under the direction of the National Research Council and because of this he may be enabled to attend despite the war, as a regulation prevents all Rhodes Scholars from proceeding overseas except those engaged in medical or scientific research.

◆

▸▸▸ The following officers were elected at a recent meeting of the Board of Directors of the Pittsburgh Piping & Equipment Company, Pittsburgh; Charles R. Hall, president and treasurer; Louis K. Hamilton, vice president; Joseph G. Gardner, secretary; Karl F. Tiegel, director of purchases and estimates, and G. Sinding Larsen, chief engineer.

◆

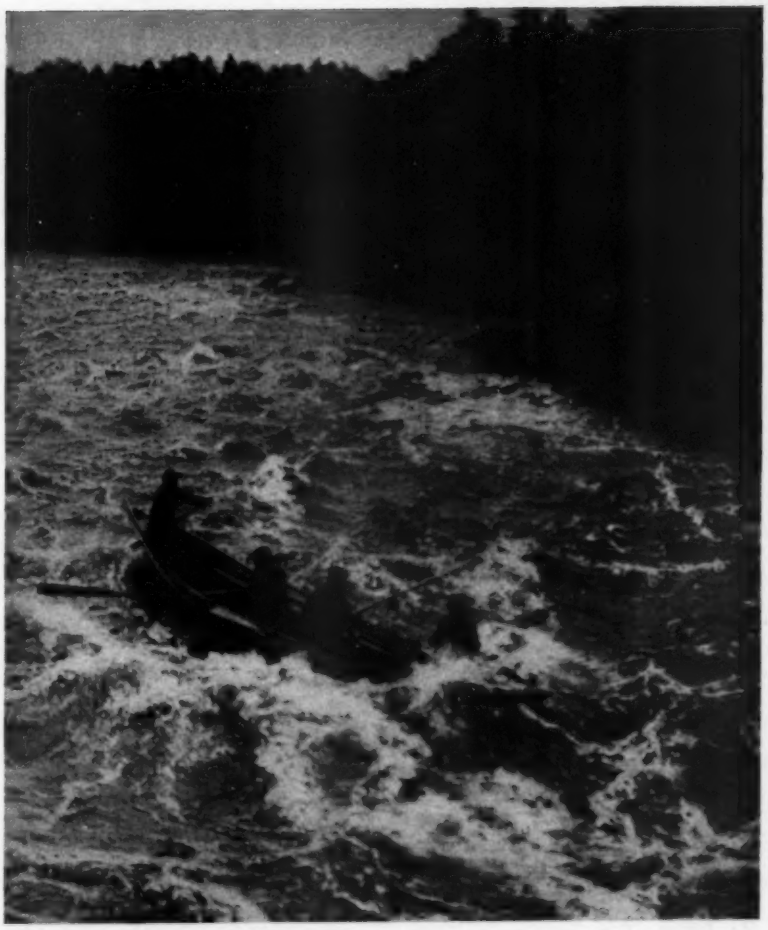
▸▸▸ Among the five recipients of fellowships of $1,500 each from the Royal Society of Canada is *William Schneider,* native of Woolsley, Saskatchewan, and a student in chemistry at the graduate school of McGill University, where he received his M. S. degree.

◆

▸▸▸ A recent announcement disclosed that *Justin R. Weddell* has been appointed assistant to the president of the Union Bag and Paper Corporation, New York. Mr. Weddell is well-versed in the field of advertising and graphic arts and has spent the last 10 years representing advertising interests in Europe. In all, he has had more than 30 years' business experience in the field.

◆

▸▸▸ The appointment of *Ervin Manske* as a general traffic manager of the Allis-Chalmers Manufacturing Company's eight plants was announced recently. In his new position, Mr. Manske will be responsible for the prompt delivery of this company's products. *Carl J. Kraus,* the former traffic manager of the Springfield, Illinois, plant, has been appointed as assistant traffic manager.



Rapid Water Expulsion in papermaking is promoted by adequate porosity in papermakers' felts. The more water expelled at the presses, the less it will cost to dry your paper.

A Draper Felt designed for your particular produc. will help in this respect to lower your drying cost and bring the paper to the dryers in a uniform state of moisture content.

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Necrology

FRANK L. STEVENS

Frank L. Stevens, 76, who headed upstate New York paper mill machinery and paper firms, passed away May 19 at his home in Hoosick Falls, New York. Mr. Stevens was organizer and president of Noble & Wood Machinery Company, Hoosick Falls, and chairman of the board of directors and former president of Stevens & Thompson Paper Company, Greenwich, New York. He also was a former New York assemblyman from Rensselaer County's second district.

A graduate of Peekskill Military Academy, Mr. Stevens was a former director of the Federal Reserve Bank, former postmaster at North Hoosick, and former trustee of Worcester Polytechnic Institute. He was instrumental in having the Bennington Battlefield Park Commission.

Surviving are his widow, two daughters, and a son.

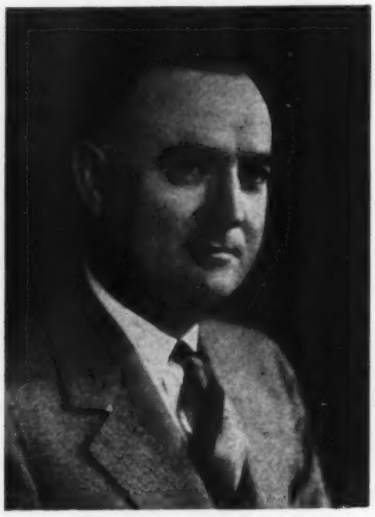
◆

▶▶▶ *Phineas B. Wheeler,* retired sales manager of the Franklin Paper Company, Holyoke, Massachusetts, passed away on May 7 at the age of 71. Mr. Wheeler started his career in the paper business 52 years ago with the Agawam Company, Mittneague, Massachusetts, and worked there until 1912, when he joined the Hawthorne Paper Company, Kalamazoo, Michigan, as manager. The following year he joined the sales force of the Franklin Paper Company and retired as sales manager in 1940. Surviving are two sons.

◆

WILLIAM A. MUNRO

William Alexander Munro, recognized in the paper industry as having an outstanding talent for organization and selection of men, passed away on May 10 at The Homestead, Hot Springs, Virginia, after serving as president of the Flambeau Paper Company in Park Falls, Wisconsin, for six years. Mr. Munro was also well-known for the active part he played in promoting reforestation and the reuse of idle lands in northern Wisconsin for the growing of timber.



William A. Munro

A member of the first graduating class in the new Forestry school at Syracuse University, Syracuse, New York, in 1913, he started his career in the paper industry in the woodroom of the Finch-Pruyn Paper Company at Glens Falls, New York, and worked up to woodroom foreman. In 1918, he joined the Navy as a first-class seaman and in a few months was advanced to second lieutenant in the Steam Engineering Division. After leaving the Navy in 1919, he joined the staff of the Wisconsin Paper & Pulp Company, Stevens Point, Wisconsin, and left in 1921 to go with the Minnesota & Ontario Paper Company.

In 1925, he went to Munising, Michigan, as resident manager for the Munising Paper Company, which position he filled until he joined the Flambeau Paper Company in 1935 as president and general manager. In his association with the men of this company and the community of Park Falls, Mr. Munro was admired and respected for his democratic way of life and his vigorous and enthusiastic participation in local affairs. His widow survives.

◆

▶▶▶ *Henry Aldous Bromley,* technical staff officer in charge of His Majesty's Stationery Office Laboratory, passed away recently at Raynes Park, London, at the age of 58. Mr. Bromley was the author of two technical books on papermaking and co-author of a third. His publications were "Outlines of Stationery Testing" and "Paper and its Constituents". The third publication was entitled "Articles of Stationery and Allied Materials".

◆

▶▶▶ *J. Fred Butler,* secretary-treasurer of the J. W. Butler Paper Company, Chicago, passed away at his home in Chicago June 2. He was 75 years of age. Mr. Butler's father founded the paper company in 1844. He is survived by a daughter.

◆

▶▶▶ *Warren G. Jones,* president of the W. A. Jones Foundry & Machine Company, Chicago, passed away June 5, at his home in River Forest, Illinois. He was 50 years of age. His widow, a daughter and two sons survive.

◆

▶▶▶ *Peter C. Servaas,* vice president and sales manager of the Michigan Paper Company, Plainwell, Michigan, passed away May 26 after a long illness. He was 62 years of age. Mr. Servaas had lived in Kalamazoo for more than 50 years, and had been connected with the Riverview Paper Company (now the Kalamazoo Paper Company) and the Bryant Paper Company before going with the Michigan Paper Company 11 years ago.

◆

EDWARD N. WHITE

Edward N. White, chairman of the board and treasurer of the White & Wyckoff Manufacturing Company of Holyoke, Massachusetts, passed away on May 21 at the age of 77. Mr. White was one of the founders of the stationery firm of Smith and White, predecessor of the present firm.

The Smith and White business was started in 1889 and in 1891 J. L. Wyckoff joined the concern. Two years later, Mr. White and Mr. Wyckoff bought Mr. Smith's interest and the firm name was changed to White and Wyckoff Manufacturing Company.

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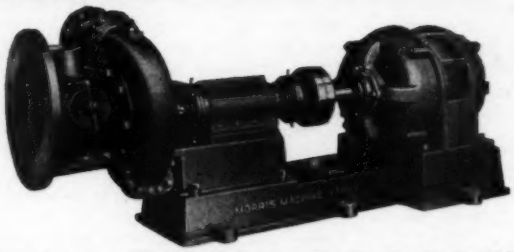

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Convention Papers . . . Abridged

Inks and Their Relation to Paper

GEORGE CRAMER, Director of Research
Sinclair & Valentine Co.

Newspaper stock as seen under the microscope immediately describes the nature of the ink which will be best suited for good results. The soft, porous nature of this stock and the process involved presupposes a drying condition entirely by penetration. It goes without saying, however, that this penetration must be definitely limited in order to avoid strike-through or oily stains on the opposite side of the sheet.

From the newsprint field we approach the use of machine-finished and supercalendered stocks. It is with these stocks that the inkmaker encounters considerable difficulty. A minute examination of these two stocks reveals that the condition as developed on printing—i. e., shiny and dull spots, etc. —can be attributed to hard and soft spots in the stock. Two distinct problems confront the inkmaker in the development of an ink which will produce suitable graphic reproduction on such stocks. The first efforts expended are generally those in the nature of increased penetrating power of the ink. When the ultimate has been obtained in this direction and the results are still unsatisfactory, then it falls upon the ink chemist to look farther into his pigment formulation and obtain an apparent uniformity of printed effect by incorporating such materials in his formulation which will be inclined to mask the mottle by means of a general dulling effect.

The recent development in papermaking of the machine-coated stock has presented the inkmaker with a new set of conditions with which he must struggle to produce prints of a satisfactory nature.

In the first place, the amount of coating applied is comparatively low, thus presenting a surface for printing which is not much better than the surfaces presented by either machine-finished or supercalendered stocks. Hard and soft spots found throughout the entire area of these stocks cause an unevenness of print which is not a simple matter to overcome as far as inks are concerned. The usual procedure followed by the inkmaker in overcoming such uneven printed effects may, in some cases, lead him into still other difficulties, such as drying. Penetrating oils, which are quite frequently used to alleviate a nonpenetrating condition, may lead to the development of an ink that will not fulfill the usual high-speed production schedules generally existent where machine-coated papers are employed.

One might get the impression that the heat-setting inks may not encounter the same difficulties as experienced by the conventional type. This is not the case, however, inasmuch as the actual results obtained in the production of magazines and journals using such baking processes have not indicated any greater smoothness of print or freedom from mottle. The inkmaker hopes that some way or another the paper manufacturer may be able to do something with this stock to assist in overcoming this apparently difficult situation. From the inkmakers' standpoint, it appears as though an increased and a more uniform coating over the body stock would aid materially in securing that uniformity of printed effect that the graphic arts demands.

Machine-coated stocks give the inkmaker still another problem with which he does not have to contend in coated stocks. Most likely the real reason for this condition is again due to the fact that the coating on these stocks is relatively thin. The stock surface is full of pin holes both large and small. Apparently the number of these pin holes per square inch is immaterial, but it is their depth which gives the inkmaker his greatest concern. Deep pin holes, even though they aren't numerous, are difficult to bridge. While it may be a simple matter for the paper manufacturer to avoid or eliminate the pin holes usually found on the surface of machine-coated stocks, yet it is a phase of his work which undoubtedly is giving his research staffs considerable concern. Closer co-operation between all parties involved will eventually lead to machine-coated stocks of outstanding merit.

The results generally obtained when regular coated stocks are employed by the printer or the lithographer are as a rule far superior to those obtained when machine-finished, supercalendered, or machine-coated papers are used. Unquestionably the improved graphic effects are on the result of the increased coating weights applied to these stocks. Coated stocks, however, are not without some drawbacks that greatly concern the inkmaker. First among these is the difficulty sometimes experienced due to the coating being picked from the body stock in the printing operation. Under ordinary circumstances this is a relatively simple matter to correct; yet there are times when, due to conditions of the press, of the paper and even of the form itself, it is almost impossible to proceed and make a good job. Quite frequently, the addition of a waxy compound, or a mineral or a sheep's wool grease will reduce the tack of an ink sufficiently to prevent any further difficulty with picking. The papermaker can aid in overcoming this difficulty by increasing the pick as is indicated by the various wax tests. He must, however, be somewhat cautious in increasing this factor, for as the pick test is increased experience has indicated difficulty is noted in the production of good halftone printing.

Chalking conditions are occasionally experienced when certain coated stocks are used. For reasons most likely known to the papermaker, every now and then a printer or a lithographer will run into a situation where all of the vehicle and binder of the ink is seemingly entirely absorbed by the coating on the paper. Unfortunately, such a situation does not become known until the major portion of the job is off the press. The correction is relatively simple and can be accomplished by using an increased amount of drier. The logical way of overcoming chalking conditions is to use a percentage of heavier binding varnishes. When following this procedure, the chances of avoiding press difficulties are more certain, as increased driers are quite frequently found to be troublesome. In this same category we find the ever present difficulties with gold ink printing. From the inkmakers' standpoint, it appears as though the penetrating factor of the paper is one of extreme importance in gold ink work. If the paper is too tight, then, while there will be no difficulty as far as drying is concerned, the effect will be dulled, due to the varnish remaining entirely on the surface. If, on the other hand, the coating on

This is the fourth installment of abridgments, prepared by our editorial staff, of papers presented at the annual meeting of the Technical Association of the Pulp and Paper Industry, held in New York City, February 17-20, 1941. Previous installments appeared in the March, April, and May issues. The remaining abridgments will be published from month to month until completed.

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the paper is too absorbent, then the aforementioned dusting condition will result. There apparently appear to be some stocks that are ideally suited for this type of work; papers that just allow enough penetration of varnish to produce a leafing effect and thus brilliancy; and yet, do not penetrate enough to cause poor binding. Metallic printing needs the co-operation of the papermaker, the printer, and the ink manufacturer for best results.

Within the past few years, the papermaker has developed a new stock designed particularly for the production of gloss ink printing. In doing this job, the papermaker is to be complimented, for without his assistance in this case, it would be impossible to produce the beautiful glossy results which have become popular so recently. The only comment that the inkmaker might make in connection with these stocks is that it would be desirable to secure more uniformity, as at present, it appears to be difficult to produce comparable results on all receipts of gloss ink stocks.

Every now and then, the inkmaker is confronted with a phase of printing in coated stocks that while it bears a similarity to the difficulty experienced with machine-coated stocks, is, nevertheless, quite different. The use of a variety of stocks indicates that there are some stocks which will clean the plates of ink as they are being impressed; yet others are inclined to be somewhat non-receptive. Papermakers no doubt have made a careful study of paper coating in respect to ink receptivity.

Offsetting of ink is still one of the pressmen's major problems; this, in spite of the fact that the recent introduction of sprays have helped considerably in this direction. The papermaker has been helpful in that there are on the market today a number of coated stocks wherein the ink will set almost immediately. There remains only a wider adaptation of such coating formulations in order to assure still greater relief from the annoyance and spoilage caused by offset.

Frequently static developed during the printing operation is a contributing factor as regards offsetting. The printer and the printing press machine builders have recognized this difficulty and have added to their equipment static eliminators, such as gas burners, tinsel, and special equipment.

The drying of printing and lithographic inks is the principal concern of all directly connected with the production of printing. The inkmaker is constantly on guard making daily checks on specific stocks to be sure that an ink will dry within the specified time. Time and again, in spite of all of these efforts, a complaint will be made in regard to the poor drying of a certain ink. Rechecks on the items in question fail to indicate any specific reason for the condition as developed. In most instances, subsequent investigation reveals that an unduly high moisture content in the stock has added to the drying time of the job in question. The standardization and the maintenance of definite moisture schedules would be of great aid in the elimination of drying difficulties.

The recent trend toward highly finished displays, and packages has led to the development of a series of new stocks coated with all types of cellulose products and other synthetics. This tendency has brought with it the need for special inks that are suitable for such specialties in paper. Flint-coated stocks were about the first of these specially finished papers that required inks of unusual formulation to make them practical from a printers' standpoint. The highly polished, waxy finish on these stocks presented a problem of adhesions as well as one of drying. The application of special binding vehicles made on a synthetic base was instrumental in aiding the inkmaker in producing a product that would fulfill both of the above special characteristics of flint-coated stocks.

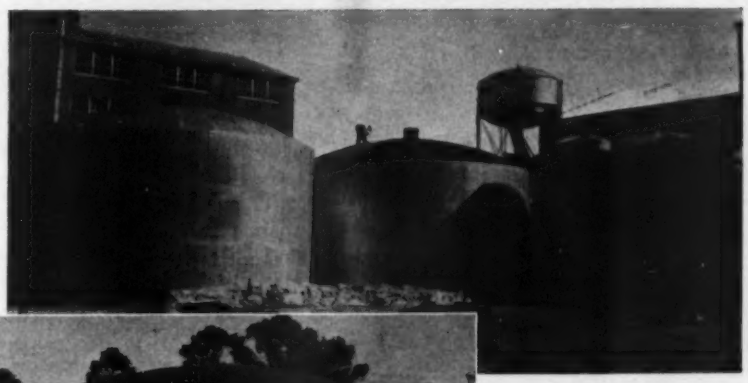
Lacquer coated stocks and their corresponding inks are now developed to a stage where the printer can safely proceed with a specific job without being especially concerned about the outcome. Here, too, the original ink formulations had to be considerably altered in order to make them suitable and compatible with the cellulose coatings that make up the surface finish of lacquer coated stocks. Inks for these stocks must be designed to suit the particular plasticizer employed.

Thus far, we have only considered the problems confronted by the typographer. There are still those paper stocks made particularly for the lithographer which demand the attention of the inkmaker in order to assist in overcoming a number of difficulties which are inherent, due to the peculiarities of the lithographic process.

The problems, in most cases, revolve around the dampening solutions used in order to effect the separation of the inked and unprinted areas. Where a proper balance is not secured in the regulation of the water, ink difficulties are bound to occur. The paper man may wonder just what relationship such a condition has to the paper being run. In many cases, stocks are so nonreceptive to water that an accumulation builds up on the offset blanket and thus creates an excess of moisture on the lithographic plate which eventually works its way back into the ink. It is desirable for a coated paper stock used for lithographic purposes to be more or less water repellent, but quite frequently some coated stocks are so tight in this respect that they may become quite troublesome. The inkmaker has at his disposal a number of ingredients which he can incorporate in his ink to minimize such unhealthy conditions, but he hesitates to go the full extent with such ingredients as in some cases other difficulties, such as picking, offsetting, and piling on the blanket are the result. Regular offset stocks are considerably less troublesome than coated stocks as far as pressroom conditions go. It is only occasionally that it is necessary for the inkmaker to make adjustments on offset stocks to avoid blanket and plate difficulties caused by fibrous accumulations.

The past several years have seen an increase in graphic decoration of all kinds of paper cartons, boxes, and containers. The use of special box wraps is gradually being replaced by such special stocks as clay-coated and patent-coated paperboards, plus a host of others that are specially designed to give the package of today an attractive appearance. The new stocks used in these manifold cartons and containers have given to the inkmaker a new set of problems which he must face in order to produce satisfactory results. The stocks above-mentioned as well as bleached manila stocks, sulphate stocks, and sulphite paperboards all require ink formulations that must be suited particularly to the stock being used by the printer. Thus in the case of a clay-coated board where a gloss finish is desired of the ink, it is essential to incorporate those ingredients that will remain on the surface. Green or moist board is troublesome. Patent-coated paperboards sometimes give the inkmaker serious concern, due to non-uniformity of printed effects resulting from uneven printing surfaces. Sulphate and sulphite stocks do not print with the same smoothness and evenness of finish and it is for this reason, particularly in the case of the sulphite, that the inkmaker finds himself adding wetting agents to his inks so that his customer, the printer, will be more nearly satisfied. During the period in which containers were being produced with board lined with jute, the inkmaker had relatively easy sailing in producing inks for the container trade. As soon as the kraft stocks entered into this field of boxmaking, new headaches were experienced, since the boxmaker insisted on producing high gloss results on kraft boxes and containers. In this particular instance, the inkmaker has been successful only to a degree and this can be traced largely to the relative differences of these two stocks as indicated when examined under the microscope.

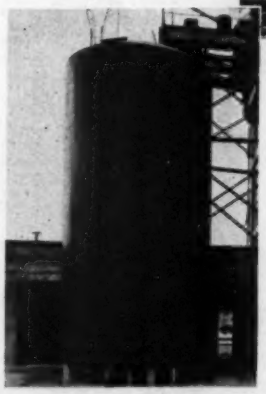
FLAT BOTTOM STORAGE TANKS
for Paper Mill Requirements



● *ABOVE: Four tanks used for liquor storage at the Brunswick Pulp & Paper Co. mill, Brunswick, Ga. In the background is a 50,000-gal. elevated water tank.*

● *LEFT: 40 ft. dia. by 20 ft. water storage tank used for fire pump supply at the Crossett Paper Mill, Crossett, Ark.*

● *RIGHT: Two 33 ft. dia. by 13 ft. 6 in. tanks used for black liquor storage at the Container Corp. of America mill, Fernandina, Fla.* ● *BELOW: 40,000 gal. hot water storage tank at the same location.*



● **The accompanying illustrations represent a typical cross-section of the various types of flat-bottom tanks for liquid storage that are being fabricated in our shops for the paper industry. All of these installations are of modern welded steel construction, designed and built to meet specific requirements. In addition to flat-bottom tanks for water or chemical storage, we are equipped to furnish elevated water tanks, welded steel pipe, diffusers, reservoirs, steel smoke stacks, bins, digesters, cookers, and standpipes. Address our nearest office for information or quotations.**

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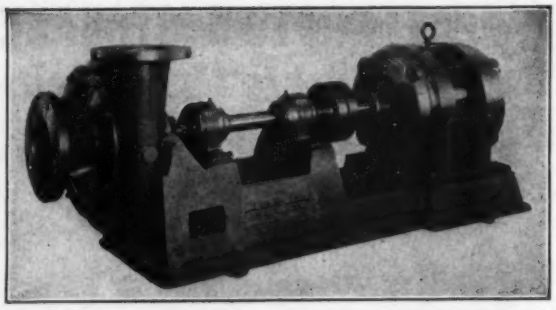

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The control is mounted on two steel channels as shown in Figure 1. These are set on top of an open box at the point where the consistency is to be controlled. There is a unit to detect changes in viscosity which is used as the measure of stock consistency. This is connected to the valve controlling the flow of dilution water so that this flow increases or decreases in proportion to any increase or decrease of the stock viscosity. The unit for detecting changes in viscosity is simply a series of flat, smooth, circular disks rotated in the stock stream by an electric motor at a constant speed of about 600 r.p.m. At any given moment, one half of each disk is moving in the same direction as the stock stream, while the other half is moving against the flow of stock. This tends to cancel any effect from change in velocity of the stock.

The consistency-detecting apparatus is not used as a mixing device, because it would affect accuracy of control. The disks are simply rotated in the stock as feelers. To assure response to the average consistency of the fluid passing the control, four disks are used. They are spaced to cover a wide enough area to permit the entire volume of stock being controlled to pass through the unit. This gives greater over-all accuracy than if only a sample of the stock were measured. The resistance to rotation of the disks depends on the viscosity of the stock. Any variation in viscosity will therefore cause a corresponding variation in the torque required to rotate the disks. The diameter of the disks and their speed of rotation were determined experimentally to provide a favorable change in torque with a given change in consistency.

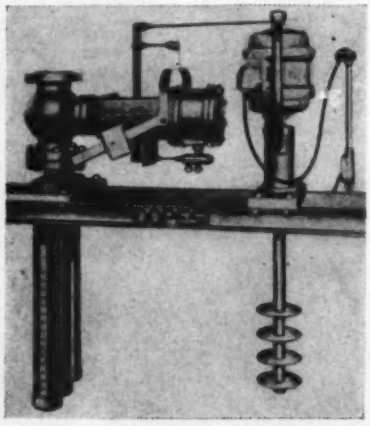

Figure 1.

At low consistency, it takes much more variation in consistency to produce a given change in torque than at a higher consistency. Since the accuracy of the torque-measuring device is constant and independent of the controlled consistency, it follows that the control is more accurate at the higher consistency settings. A controlled consistency of 3 to 3.5 per cent is usually recommended, although these are by no means the low or high permissible limits.

The torque-measuring mechanism is of the dynamometer type. The ¼-hp. motor driving the disks at a constant speed of about 600 r.p.m. is supported vertically from its shaft by a cast iron bracket. Its frame is free to turn through an angle of about 300 deg. in response to torque changes produced by the rotating disks.

The tendency for the motor frame to turn is counterbalanced by weights on the dilution valve levers. The connection between the motor frame and the valve is a thin, flexible stainless steel tape wrapped around a pulley fastened to the upper part of the motor frame and attached to the weighted valve lever. With the weights close to the valve, a low consistency is maintained. As the weights are moved away from the valve, the controlled consistency is increased.

To assure greater sensitivity, only a small amount of energy from the torque-measuring mechanism is used to initiate operation of the dilution water valve. This valve is hydraulically-operated, the operating medium being clear water at any pressure from 30 to 100 lb. per sq. in. Movement of the tape in response to torque changes acts through a lever to operate a small but sensitive pilot valve. This pilot controls the hydraulic energy actually operating the dilution valve. The valve size is carefully determined for each installation and the general practice is to use V ports accurately designed for the most desirable flow characteristics.

Water from the dilution valve is admitted to the stock through 3 distributor pipes. Holes in these vertical pipes permit a thorough cross-sectioning of the stock with water. The dilution point is placed as close as practicable to the control point, the actual distance being less than 3 feet. This minimizes the time lag between the measurement of consistency and the corrective dilution of stock, making hunting of the control virtually impossible and thus permitting greater accuracy of control of the maintained consistency.

The diluted stock is then directed through a converging channel in which the 4 horizontal rotating disks measure the consistency. Since the dilution water is admitted to the stock in more or less vertical planes, measuring the consistency in horizontal planes through the entire stock flow assures an average measurement of the controlled stock density.

In a sulphite paper mill, the control was installed ahead of the jordan, stock for which was pumped from a chest into which 5 beaters were discharged. The stock from the beater nearest the chest was at a much higher consistency than that from the most remote beater. This caused a wide variation in the consistency of the stock entering the chest, depending on which beater was being discharged. *Consistency* was measured on the moisture-free basis from samples taken at 15-minute intervals. The desired consistency was 3.0 per cent. The average maintained was 2.98 per cent; the range from 2.8 to 3.1 per cent. The control handled all the stock for a Fourdrinier producing about 35 tons of paper a day.

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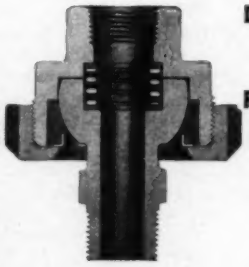

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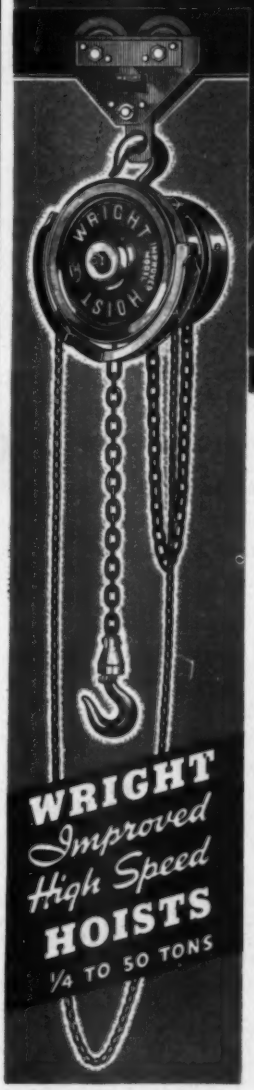

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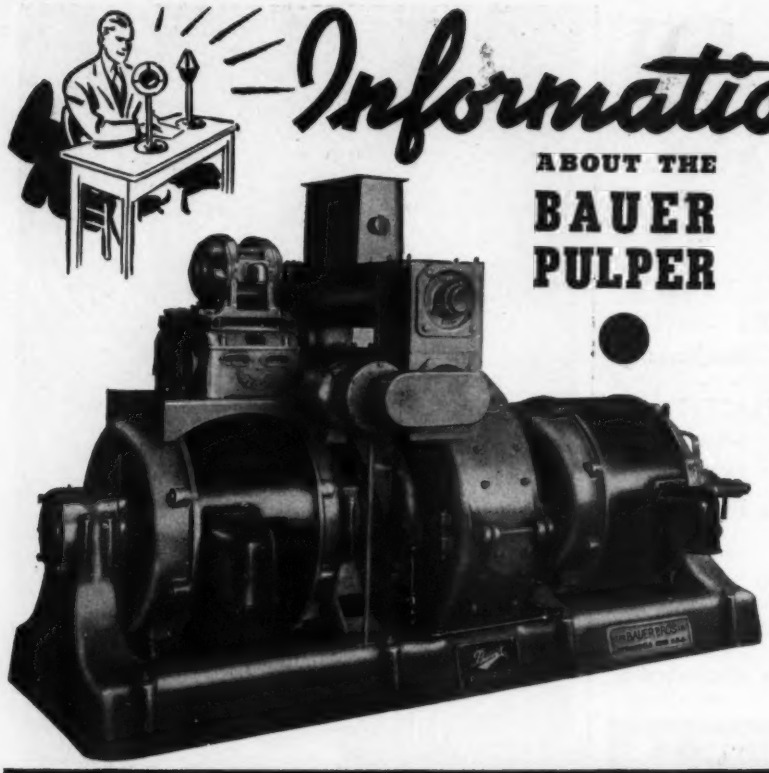

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Q. Is there more than one size?

A. Yes, in the 36" and 24" diameter disc sizes. There is also a full range of plate patterns. And here's a question for you: Why not write today for details?

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The New Index of Industrial Production and the Paper Industry

LOUIS T. STEVENSON

At the Annual Meeting of TAPPI in February, 1936, a paper was presented entitled, "The Paper Industry and the Business Cycle." (Technical Association Papers Series XIX No. 1, pp. 152-155.) The Federal Reserve Board's Index of Industrial Production was used as a representative series which conformed rather closely to the movement of the Business Cycle. (*Ibid.*, p. 153)

Comparing the Index of Industrial Production with one of Total Paper Production the conclusion drawn was that industrial production and paper production moved in the same direction and at the same time but not to the same extent in depressed periods. (*Ibid.*, p. 155)

Last August the Index of Industrial Production was completely revised and revamped. (cf. *New Federal Reserve Index of Industrial Production* reprinted from *Federal Reserve Bulletin* for August, 1940, hereinafter referred to as *F.R.B. New Index.*) Among the revisions were five paper series and four pulp series. The base period also was changed from the years 1923-25 to that period included in the years 1935 to 1939. (*Ibid.*, p. 8)

The new Index of Industrial Production is broadly similar to the old Index both in timing and in degree of change. (*Ibid.*, p. 2) There are however important differences. The new series, due to the inclusion of a number of new and faster growing industries, has an upward trend while the old series had a slightly downward tendency for the same period. The 1929 peak in the old Index is almost ten points higher than the new Index, while throughout 1940, the new Index is higher than the old. (cf. *Ibid.*, Chart I p. 2)

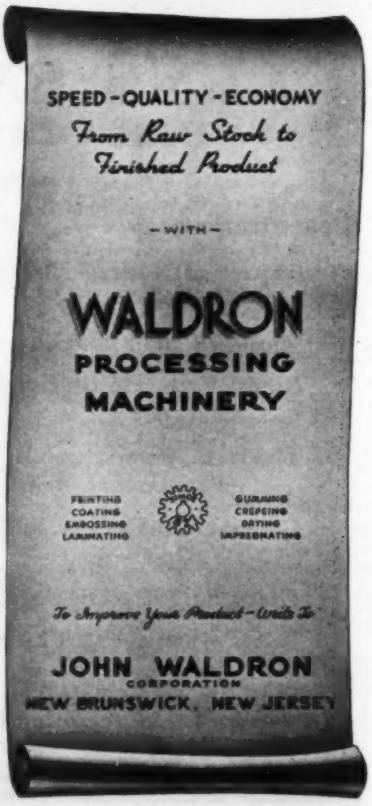
Industrial Production is divided by the Reserve Board statisticians into three parts, namely,

1. Durable Manufactures
2. Nondurable Manufactures
3. Minerals.

Durable manufactures include such items as iron and steel, automobile production and lumber production. Nondurable manufactures include clothing, food stuffs, and paper. Mineral include fuels and metals. Paper production accounts for approximately 4.6 per cent of the nondurable manufactures in the base period. (cf. *F.R.B. New Index,* pp. 9-11) From this fact, one would expect that nondurable manufactures and paper production would have fairly similar behavior.

The trend of paper production has been upward for so long that it seems to be a settled habit of the industry. There is apparently no end in sight at the moment. 1940 according to latest advices was the greatest year for paper production in the history of the country.

It seems clear that paper production and industrial production as exemplified by the New Index move upward and downward at practically the same time if both series are adjusted for seasonal variation.



However, the swings of paper production generally coincide in amplitude and timing more closely with those of nondurable goods. (cf. *Monthly Bulletin of American Paper & Pulp Association*, October, 1940, pp. 1 and 2.)

The Chemipulper

ARNO W. NICKERSON,
Consulting Engineer

The chemipulper is an Asplund Defibrator with a Beveridge-Kehoe reaction chamber interposed between the feed and the defibrator refiner, thus increasing the time the raw material is subjected to temperature and pressure. The chemipulper is therefore essentially a combination of continuous digestion (cooking) with continuous refining under pressure.

A range of chemicals of varied concentration have been applied, including pretreatment with acids and treatment with sodium carbonate, sodium hydroxide, and sodium sulphite. The latter, termed neutral sulphite, is a logical method of treatment because of its relatively low cost, its reducing action, and the solubility of its compounds.

To sodium sulphite can be added sufficient quantity of sodium carbonate, or hydroxide to neutralize such organic acids as are liberated and thus maintain the neutrality of the reaction as cooking proceeds. Concentration of chemicals, time, and pressure during treatment will be governed by species of wood or annuals to be treated.

At present there are two chemipulper units in operation, using pine and the sodium hydrate process of cooking.

Initial developments in chemipulp indicate that cost will be low, and that strength values at even high yields (89 per cent) are in a range which will be satisfactory for a "freeing" filler for chipboard. At lower yields and applied to deciduous woods, fibers produced will be useful in many grades of solid wood pulp boards. Converter mills, located in areas where birch or poplar is available at low cost, can produce a portion of their pulp needs at low cost and at a reasonable capital investment. Straw for nine-point can be produced at considerable saving over present cooking methods. Fibers for nine-point kraft can be produced at definite economy levels.

Paper Mill Wire Corrosion

HARRY G. SPECHT, Eastwood-Nealley Corp.

The paper machine is our laboratory and from it we have drawn our conclusions. We have also run laboratory tests and found that with a given acid solution, we increased corrosion from two to four times with a rise of 50 deg. of temperature and we increased the corrosion rate from 10 to 20 times with the use of air in the solution. The different results were obtained with different alloys, different acid solutions and strengths of solutions and varying volumes of admitted air.

The different forms of corrosion are: direct chemical action, pitting or galvanic (two metal cell) action, dezincification and corrosion cracking with (helped by) fatigue.

Direct chemical action occurs when acids

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Atkins Chipper Knives. Made of special analyses steel, specially heat treated, tempered and ground to assure consistently uniform, sharp-cut chips.

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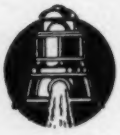

THE Southland Paper Mills plant at Lufkin, Texas, is the first erected to make newsprint from yellow pine. Typical with the majority of paper mills, Layne Wells and Pumps are used to supply their water needs. Five units provide over 10,000,000 gallons daily.

Layne Wells and Pumps also serve cities, towns, communities, defense plants, army camps, air fields, railroads, packing houses, breweries, chemical plants and a wide range of other industries.

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Layne-New York Co.	New York City.
Layne-Northwest Co.	Milwaukee, Wis.
Layne-Ohio Co.	Columbus, Ohio.
Layne-Texas Co.	Houston, Texas.
Layne-Western Co.	Kansas City, Mo.
Layne-Western Co. of Minnesota	Minneapolis, Minn.
Layne-Bowler New England Corp.	Boston, Mass.
International Water Supply	London, Ontario, Can.

and reactants combine with the metal to form non-metallic salts. Air, the most prevalent form of an oxidizing agent will greatly accelerate this action.

Many cylinder mills operating with alkali solutions have wire failures due to galvanic action.

Pitting is caused by inclusions which corrode easily by galvanic action accelerated by oxidizing agents. Where there is an uneven distribution of strains, pitting more readily occurs. Pitting may occur in any alloy.

Dezincification occurs in fourdrinier wires due to the use of copper-zinc alloys in weft or shoot wires. The most favorable conditions for this type of corrosion seem to be a slightly acid condition, or a salt solution and the presence of oxygen. A rise of temperature plus the presence of air accelerates dezincification.

Corrosion (of any form) attacks first the surface of the metal and combined with fatigue, the action proceeds more rapidly due to the development of cracks which cause a further penetration of the corrosion. This form of corrosion comes up in connection with excessive souring. The presence of air will increase rate of attack and decrease time to failure.

The acidity factor in most mills, as represented by the *p*H measurement, will at temperatures below 60 deg. cause little trouble in shortening wire life.

With a given *p*H, the corrosion factors will increase as the temperature rises towards 80 deg. and with low water and increased air absorption, corrosion is greatly accelerated to an alarming degree.

To correct these conditions, steps should be taken to de-aerate water and remove dissolved air.

Temperatures should be kept as low as possible. In a paper mill, water is constantly being aerated and some thought should be given to the subject of de-aeration in general practice. This is the greatest factor we have to contend with in wire corrosion.

Roberts Grinder

A. E. BARTLETT, General Superintendent
Algonquin Paper Corporation

The Roberts grinder is not only compact; it produces at a high rate a clean type of stock at a low horsepower rate per ton.

A large cast iron ring, 8 feet in diameter, is mounted inside a cast iron housing so that the ring saddles in a trunnioned frame. This frame is mounted on a base to allow the ring to be adjusted to the stone. This whole arrangement is mounted eccentrically around a grindstone (say 54 inches diam.) so that the ring almost contacts the stone at about the 7 o'clock position. This then leaves a small space on the one side and a large crescent space on the other side. In this larger space a baffle is built to form a loading pocket for the wood. On the narrow side a baffle is built to form a sliver pocket.

The ring is rotated by an oil motor, which can be run at various speeds. The lathe, heavily built, is mounted above the stone and is operated by an oil motor. The lathe head carries through the back frame to make burr changing accessible. Mounted behind the wood pocket baffle is the shower so that the stone can be cleaned before it contacts the wood.

The casing is so built that the stock when ground is forced through large breathing holes in the inner wall of the housing which forms a channel for the stock with the outer wall of the frame. In this channel is mounted a controlling weir.

The stone is rotated, by whatever power that is used, at a constant speed (240 r.p.m.), and the ring is rotated in the same direction as the stone. Wood is then loaded into the pocket and filled up to the limit (this is usually about half a cord).

The wood contacts the stone for about 50 inches and grinding takes effect over this whole area, pressure being applied through the ring rotation and weight of the wood. As the wood is ground the pulp passes out sideways through slots in the inner frame into the stock outlet channel. Slivers will work through the nip but are caught by the sliver catcher at the back and ground. The pulp is forced out of the grinder through the channel on each side and dams are inserted in this outlet to whatever control is required.

The ring speed can be varied to create varying pressures, and therefore different rates of grinding and various qualities of pulp can be obtained. The speed is controlled by an electrically operated valve in the oil motor line, and this is kept under control by the motor input.

Results obtained with this machine are compared with a line of two 3-pocket grind-

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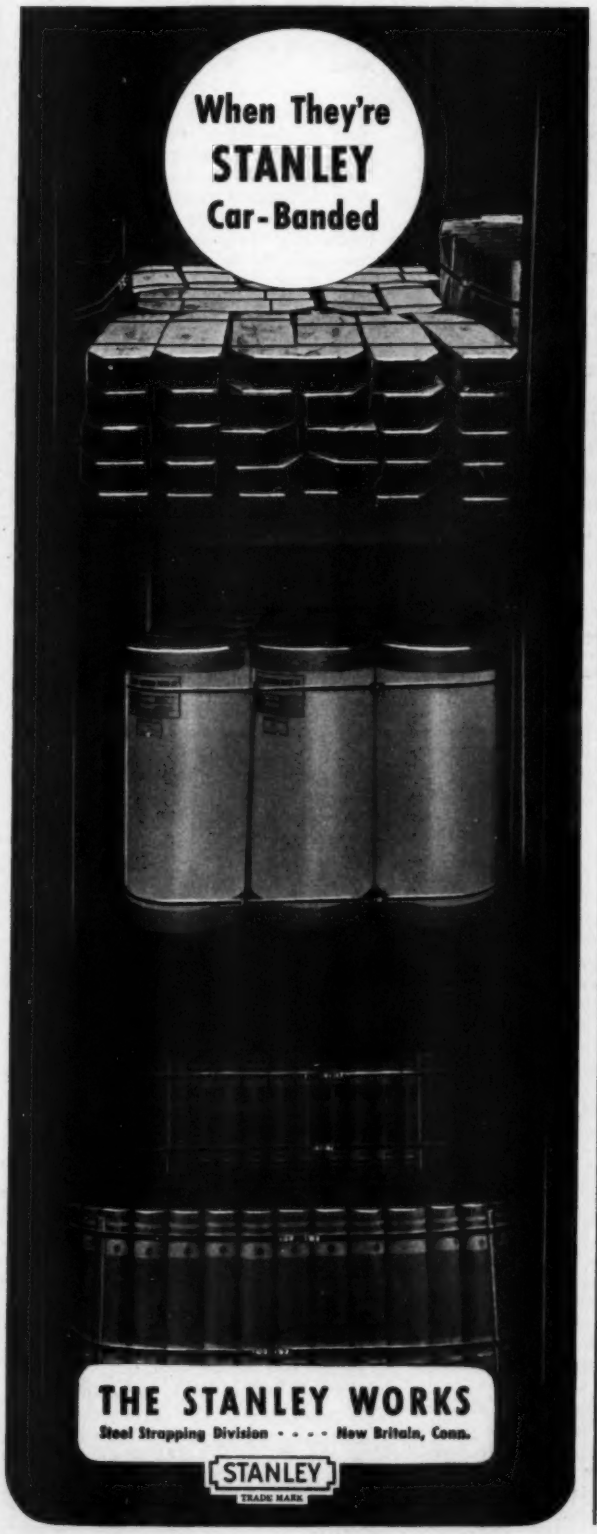

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ers, using the same wood and operating side by side.

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Sulphite Pulp from Douglas Fir—A Summary*

G. H. CHIDESTER[1] and J. N. McGOVERN[2]

Sulphite pulping experiments on Douglas Fir have shown the following results:

1) The pulping action of calcium base sulphite liquors, which do not ordinarily give complete reduction of Douglas Fir, was improved by high sulphur dioxide concentration and long time at low temperature. The pulps were characterized by a dark color, long coarse fibers, fair bursting strength, and in some instances, high tearing strength. They appear to have papermaking possibilities. Pulp having a high alpha-cellulose content can be produced by further purification and bleaching.

2) Wood variables had a considerable effect on the sulphite pulping of Douglas Fir: sapwood was readily pulped whereas the heartwood was not; seasoned wood pulped more easily than green wood; old, slow-growth wood was more difficultly reduced than young, rapid-growth wood; top portions of trees yielded lower screenings and pulps with lower bleach requirements and tearing strengths than did lower portions; and short chips (¼ inch) were more suitable than average length chips (⅜ inch).

3) Sodium base sulphite liquors reacted in a more normal pulping fashion than did calcium base liquors and consequently reduced Douglas Fir reasonably complete.

4) Both sodium bisulphite and sodium sulphite liquors reduced Douglas Fir completely. The neutral sulphite liquor produced a fairly light-colored, high-strength pulp having a low bleach requirement but low yield.

5) Douglas Fir, impregnated with sodium sulphite liquor, was completely pulped with a calcium base sulphite liquor low in combined sulphur dioxide.

6) Ammonia base sulphite liquors reacted toward Douglas Fir similarly to sodium base sulphite liquors.

7) Magnesium base sulphite liquors occupied a position between calcium and sodium base liquors with respect to pulping Douglas Fir, magnesium bisulphite liquors, like sodium bisulphite, gave a high yield of hard-bleaching pulp with a small amount of screenings.

The more complete utilization of Douglas Fir is recognized as a major problem in the forestry of the Pacific Coast region. It has been frequently mentioned that better methods for utilizing the great amount of mill and woods waste would not only increase the returns from the forests, but could provide large quantities of relatively low cost material to any converting industry. Although the quantity of Douglas Fir used for pulp is comparatively small at the present time, owing to a preference for other species, an increased use of Douglas Fir for pulp still remains, in the opinion of many, one of the most promising outlets for this large supply of waste material.

For these reasons the pulping of Douglas Fir has had a prominent place in the program of the Forest Products Laboratory. A number of investigations of pulping Douglas Fir by the kraft, soda, acid sulphite, and neutral sulphite processes and by modifications of these processes have been made. It is the purpose of this report to summarize the work on sulphite pulping, showing results obtained with calcium base sulphite liquor using different temperature schedules and liquor concentrations, with substitutions of sodium, ammonium, and magnesium for calcium in the cooking liquor, and with combinations of sodium and calcium as bases.

The Douglas Fir wood used in these experiments was derived from trees comprising several age and growth types. The wood was converted to ⅜-inch chips, and in one case to ¼-inch chips, in the usual manner. The various cooking reagents were prepared by passing sulphur dioxide from a cylinder into a suspension of calcium hydroxide, magnesium oxide, or a solution of sodium hydroxide.

The digestions were carried out in experimental digesters of several types and sizes: (1) a 50-pound (pulp capacity) stationary digester having a ceramic lining; (2) a 50-pound alloy-lined digester; (3) a 1.5 cubic-foot alloy-clad autoclave; and (4) perforated alloy baskets placed in the 50-pound alloy-lined digester. For the calcium and sodium base liquors digesters numbers (1), (2), and (4) were used; for the ammonium base liquors digester number (1) was used; and for the magnesium base liquor digester number (3) was used.

(1) Senior Engineer, (2) Assistant Technologist, Forest Products Laboratory, Forest Service, U. S. Department of Agriculture.

*A Summary of Experiments at the Forest Products Laboratory, Maintained at Madison, Wisconsin, in co-operation with the University of Wisconsin.

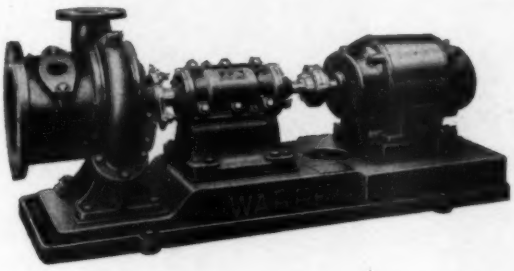
Comparison of Water-Ground Natural and Precipitated Calcium Carbonates for Paper Coating

A. R. LUKENS[1], C. G. LANDES[2], and T. G. ROCHOW[3]

In the last few years the use of calcium carbonate in paper coating formulas has become quite common. Although the "precipitated" carbonates commonly used give a much lower gloss than clays, the better color and good hiding power of these carbonates, together with moderate cost, have contributed to considerable usage.

One of the drawbacks to the employment of precipitated calcium carbonates is the fact that these pigments, if sufficiently fine in particle size to be suitable for use in high

(1) Research Director, Thompson, Weinman & Co., (2) and (3) American Cyanamid Co., Stamford Research Laboratories.



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grade printing paper coatings, require a high proportion of adhesives, such as casein.

This paper describes a new type of calcium carbonate pigment which recently has become available in a quality suitable for use in high grade paper coatings, and which has unique and useful advantages. This new pigment has most of the desirable features of the commonly used precipitated carbonates, such as good color and hiding power, and at the same time has a much lower casein requirement, thus enabling marked economies in many instances.

The new product is made from pure, natural calcite rock by a special process involving water-grinding and mechanical separation to obtain suitable particle size and other characteristics. In this investigation the special water-ground natural carbonate will be referred to under the trade name "Cal-Micro". This same product is known to the paint and rubber industries as "Atomite".

Of course, there are many grades and types of precipitated carbonates used by paper coaters today. Various paper mills and chemical manufacturers make this pigment, each probably using raw materials and processing methods to suit their own requirements. For purposes of this study it was necessary to select a single typical precipitated carbonate for direct comparison with Cal-Micro, the special water-ground, natural carbonate. It should be understood that all subsequent mention of precipitated carbonates refers to the selected representative sample, unless explicitly stated otherwise.

The Cal-Micro is composed of *solid* fragments and cleavage rhombs with relatively smooth surfaces, whereas the precipitated carbonate is composed of *porous* particles, each of which is a crystalline aggregate of a great number of tiny prisms, oriented more or less radially to form a crude sphere of extremely rough surface. This difference in particle structure between the precipitated carbonate and Cal-Micro accounts for the greater specific surface of the precipitated carbonate, and is manifested in its higher bulk, oil and water absorption, and casein requirement.

Cal-Micro is produced by grinding calcite in such a way that a great proportion of the particles are rhomb-shaped. The rest of the particles are fragmental in shape but with rounded corners and edges.

The shape of a precipitated particle is influenced by the space lattice and also by the conditions of precipitation and storage. The shape of the particles in the precipitated carbonate are crudely spherical with very rough contours, indicating that the surfaces are very irregular in elevation and extensive in area. These properties are manifestations of the structure of the particle, which is composed of a huge number of very tiny prisms interlocked, presumably by crystalline forces (as multiple twins). The result is a very porous interior and a very rough exterior. These prisms are so small that they tax the resolving power of the optical microscope.

The individual particles of Cal-Micro are solid, clean-surfaced and microscopic in size.

Relatively speaking, the precipitated carbonates "absorb" a large amount of casein, while the water-ground carbonates of similar over-all particle dimension present clean surfaces of limited area which "adsorb" a much lower quantity of this adhesive per unit weight of pigment.

It is possible that other factors also are involved in the decidedly lower casein requirement (to be demonstrated subsequently) of the water-ground natural carbonate. For example, a recent patent [Jones, C. A. & Montgomery, W. J., U. S. Patent No. 2,210,835 (August 6, 1940)] covers the wet grinding or rubbing of precipitated carbonates as a means of moderately lowering adhesive requirements.

When Cal-Micro is made into a slurry with distilled water or *p*H 7, stirred vigorously for five hours, and then filtered, the filtrate shows a *p*H or 7.1 to 7.2. This indicates that soluble alkalies are not present.

It has been stated (Private communication to one of the authors, from Mr. Norman I. Bearse, Champion-International Co., Lawrence, Massachusetts) that a normal thickness of the coating on a finished coated book paper is approximately 0.0006 inches. This is equivalent to about 15 microns. The largest particles in Cal-Micro have a "diameter" of about 10 microns, indicating that the maximum particle size is within a safe limit.

Very little data have been published with regard to the proper minimum particle size for paper coating pigments, although work in other fields [Stutz, George F. A., Jr., Franklin Inst. J., 210, 1: 67-85 (July, 1930)] indicates that the presence of particles appreciably less than 0.25 microns tends to cause a decrease in the reflectance or "brightness".

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● There's a difference in the way bed plates are built, and if you'll try SWW plates, you'll see what we mean. Standard and special designs in materials that will best do the job you have in mind.

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No More Steam Fit Troubles Here—

Bird & Son, Inc. uses 297
JOHNSON JOINTS

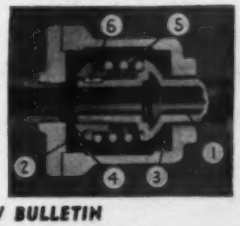
COMPARE your plant with this well-known, up-to-the-minute paper mill. Do you still have to oil and adjust steam fits? Do they have to be repacked regularly? Does misalignment of piping or rolls make frequent replacement of steam fits necessary? Do your syphon drainage pipes wear themselves out on dryer journals?

Then you should investigate the Johnson Rotary Pressure Joint, the modern steam fit that puts an end to all these troubles. It offers such important benefits and savings that it has set an entirely new pace in the paper-making industry. Over a hundred mills now use 50 or more Johnson Joints. Thirty-seven mills—like Bird & Son, Inc.—have purchased anywhere from 100 to as many as 760.

Don't let the moderate cost of changing over keep you from securing this efficient, trouble-free operation for your plant. Johnson Rotary Pressure Joints actually save enough, in reduced maintenance alone, to pay for themselves in just a short while.

HOW THE JOHNSON JOINT WORKS

Nipple (1) is fastened to roll of paper machine, calender or corrugator. Collar (2) is keyed (6) to nipple, but is free to slide back and forth. Carbon-graphite seal ring (3) and bearing ring (4) eliminate packing and are completely self-lubricating. Spring (5) is for initial seating only; in operation joint is pressure-sealed—adjusts itself automatically for most efficient operation.



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USE THE JOHNSON ELECTRAP

● Today's highest development in a trap for pumping or lifting service and draining systems under high vacuum. Electric operation removes stuffing boxes, floats and all other moving parts from trap chamber. Control valve gear is one compact assembly—can be mounted in any convenient location if trap chamber must be set in inaccessible position. New bulletin gives all the details.

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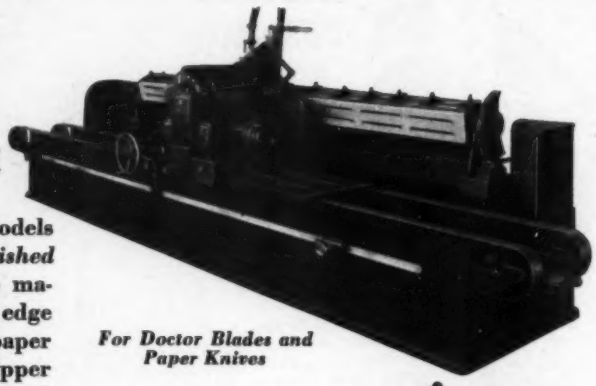
THE VALUE OF *proved* SUPERIOR SERVICE



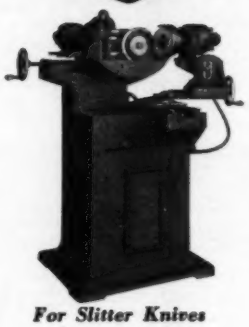
For Doctor Blades and Paper Knives

The *promise* in the earlier design of the models here shown, has now become the *established standard* in the latest development of these machines, for strictly precision grinding, keen edge finish, wet or dry grinding of slitter knives, paper knives, doctor blades, barker knives, chipper knives, and all straight or bevel edge grinding, and universal slitter knife service.

• • •

Superior, *proved*, service was never better exemplified than in these two machines, definitely establishing the better grinding standards for slitter knives, paper knives and doctor blades, which are now becoming the standards of the industry through the development and wide adoption of these machines.

Superior, economical, proved. Developed by the pioneers in the industry. Complete catalogue sent free upon request.



For Slitter Knives

COVEL-HANCHETT CO.—Big Rapids, Mich., U.S.A.

Naturally, one would expect the adhesive requirement to increase enormously with the presence of a large proportion of particles of very small size.

Although comparatively easy to select suitable maximum and minimum particle size limits for a paper coating pigment, it is a very difficult problem to predict theoretically the effect of varying particle size distributions between set maxima and minima, of about the values indicated previously as being desirable. It would seem reasonable, however, to assume that a mixture of large, medium, and small particles would give better results than particles of a uniform size.

The distribution of particle sizes of Cal-Micro fulfills the concept given above, as the greatest percentages by weight are of medium size, with decreasing percentages as the sizes approach the maximum and minimum size limits. However, it is recognized that a pigment, such as Cal-Micro, will seldom be the only pigment in a paper coating formulation. Naturally, the properties of any other pigments must also be considered in drawing conclusions as to proper particle size distribution in the mixture.

In preparing coating colors, it is noted that those containing water ground calcium carbonate can be made at 5-10 per cent higher solids contents and still have the same fluidity as the colors containing the precipitated carbonate. Likewise, in dispersing the pigments prior to addition of the casein, solids contents of the mixtures containing Cal-Micro are 5-25 per cent higher.

This difference in solids contents of the finished colors should make possible appreciable savings in coated paper drying costs, the amount of the saving depending primarily on the proportion of water-ground natural carbonate used in the formula.

The dispersibility of the water-ground carbonate is shown to be very good, as in every case the finished colors containing this pigment showed a lower grit content.

For dispersing Cal-Micro in water, the solids content of the mix should be about 60-65 per cent. The water content of such a mix is lower than when other pigments, such as clays and precipitated carbonates, are used. If too much water is used, dispersion may not be satisfactory because of lack of proper rubbing and shearing action between the pigment particles.

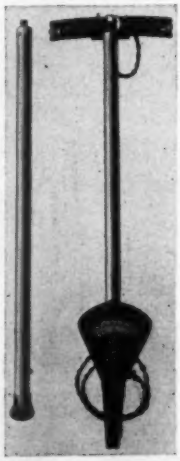
Cal-Micro may be classed with the other very "bright" pigments used in paper coating, such as satin white, blanc fixe, and precipitated calcium carbonate. It is definitely a much "whiter" pigment than the regular and fine particle size china clays. Although slightly lower in "brightness" than a few of the precipitated carbonates, Cal-Micro usually can be substituted for such carbonates without causing a drop in brightness of the paper, because of the lower amount of casein required.

Cal-Micro, when sized with an equal amount of casein, gives a much lower gloss and surface smoothness than either clay or fine particle size precipitated carbonates. However, when sized to the same wax test, Cal-Micro and high grade precipitated carbonates give about equal surface and gloss.

The following specific fields of application in the coated paper industry are suggested for Cal-Micro:

1. As a partial or complete substitute for precipitated carbonates in many book paper coating formulas.
2. As a substitute for a portion (not all) of the satin white in high gloss coatings.
3. Blended with high finish clays to give high gloss coating of extremely low casein requirements.
4. Blended with regular coating clays to give low cost coated sheets of moderate or low gloss.
5. Blended with both regular coating clays and precipitated carbonates to give low cost coated sheets of moderate or low gloss.
6. In boxboard and flour sack coatings, etc., where color and hiding power are important, but printing requirements less severe than for book papers.
7. In specialty coatings such as for tags, box-wrap paper, etc.
8. For coated papers which are to be lacquered or varnished.
9. In coating mixtures (containing casein) applied at the paper machine, where high solids and low viscosity of the coating colors are important.
10. In multicolor printing jobs (blended with clays) where the high ink absorption of precipitated carbonates is undesirable.

Don't let rejects spoil your day



The Cambridge Pyrometer is ideal for checking temperatures of still and moving rolls. This handy, accurate instrument, used regularly as a routine precaution, enables you to avoid curling, cockling, breaking and many other causes of rejects. Conserves steam, helps make better paper, increases production.

The Cambridge is made with an extension attachment to reach otherwise inaccessible rolls.

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CAMBRIDGE

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Send for descriptive literature. The use of these instruments will help you make better paper.

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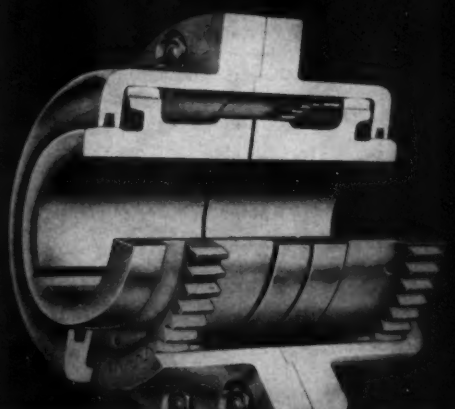

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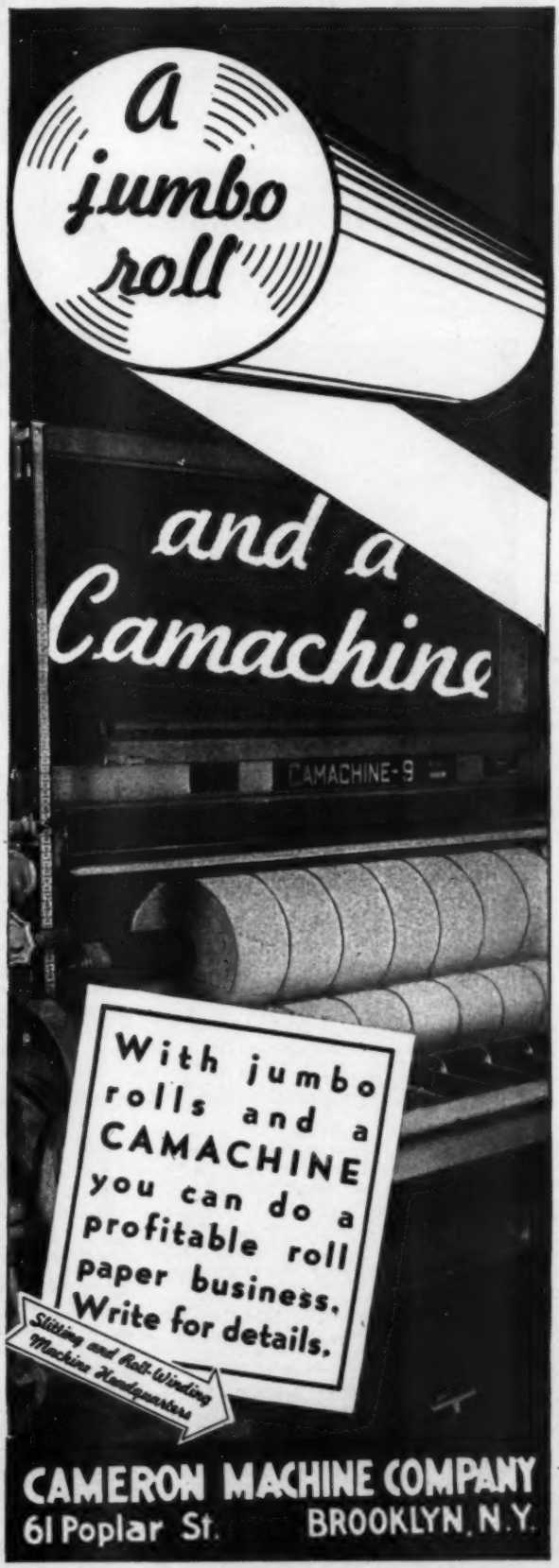
FLEXIBLE COUPLINGS

POOLE FOUNDRY & MACHINE COMPANY WOODBERRY, BALTIMORE, MD.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With jumbo rolls and a CAMACHINE you can do a profitable roll paper business. Write for details.
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NEW EQUIPMENT AND SUPPLIES

Thermocouple Temperature Indicator

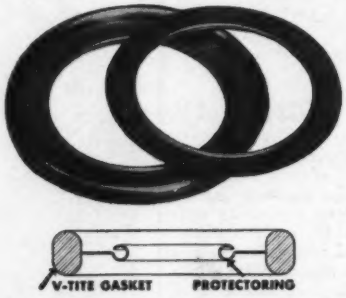
Leeds & Northrup Company, 4934 Stenton Ave., Philadelphia, has developed a portable instrument for thermocouple temperature measurements, for checking thermocouples, or for measuring small emf's. This potentiometer, designated as the *8667 Indicator,* has a range from 0 to 111 millivolts with a limit of error of ± 0.1 millivolt. Built into the instrument are coarse and fine battery rheostats, pointed galva-

nometer, standard cell, battery, galvanometer key and standardizing key. The case is 12¼ in. by 7¾ in. by 7⅞ in. It is of oak and is equipped with hinged lid and carrying handle.

Ring-Type Joint Auxiliary Seal

The Goetze Gasket and Packing Company, New Brunswick, N. J., has announced an auxiliary seal, designated as *Protectoring,* or use with Goetze V-Tite gaskets as used in ring-type flanges. The auxiliary seal is a formed ring, proportioned to fit, which is placed between the flange faces inside the primary ring gasket.

The seal is designed to protect the inner surface of the primary gasket and the otherwise exposed flange faces from chemical attack, to eliminate turbulence in pipe lines caused by eddying of the flowing liquid in the space between the mating flanges, and to prevent erosion in flange faces and



primary gaskets caused by the scouring action of liquid in motion. It is furnished in any desired metal or combination of metals, such as steel, stainless steel, Monel, aluminum, etc.; and is available either separately or in combination with V-Tite gaskets.

Three Hand Lift Trucks

The Yale & Towne Mfg. Co., Philadelphia, has announced three hand lift trucks —the new *Blue Streak,* the improved *Red Streak,* and the *Load King.*

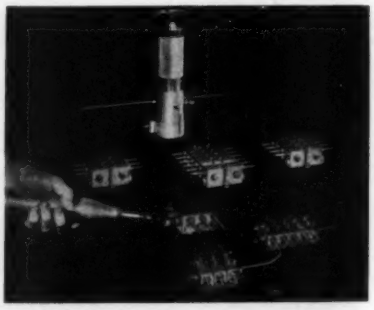
The new Blue Streak is made in two models—wide and narrow frames—each with a capacity of 2,500 lb.; the improved Red Streak, in either wide or narrow frame models, each with a capacity of 3,500 lb.; the Load King, a hydraulic hand lift truck, in capacities of 3,500, 5,000, 6,000 and 8,000 lb.

Both the new Blue Streak and the improved Red Streak feature 90 degree lift and 180 degree steer; the Load King, full 200 degree lifting and steering.

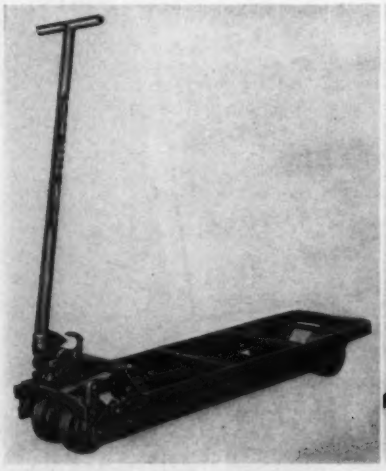
Among other features, cited by the manufacturer, for these three trucks are the following: Blue Streak—new type balanced tubular handle, machine-turned wheels mounted on Hyatt roller bearings, new counter-balanced load retaining hook, shorter handle stroke, and improved lift hook; Red Streak—fewer moving parts in lift mechanism, balanced handle, steel wheels (with machined-smooth face) mounted on ball bearings; Load King—self-contained, totally-enclosed, hydraulic lifting unit (5 pint oil reservoir), one-piece frame, front head and wheel fork of heavy steel castings, large Timken thrust bearings on steering column, ball-bearing equipped machined-faced steel wheels on standard models, balanced tubular handle, and load platform and lifting saddle of reinforced heavy plate and bar steel and of arc-welded construction.

Forced Feed Lubrication Distributor

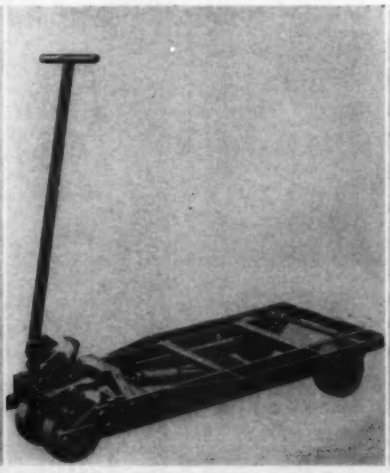
Trabon Engineering Corporation, 1814 E. 40th St., Cleveland, has announced a non-reversing single inlet multi-outlet lubrica-



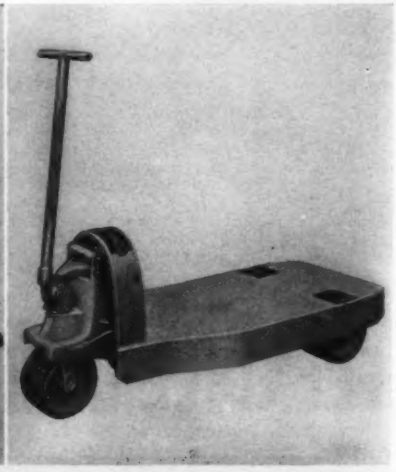
tion feeder or distributor. The distributor consists of three or more sections, each of which discharges a measured quantity of lubricant alternately through one or two discharge outlets which are direct-connected to bearings. The capacity or volume



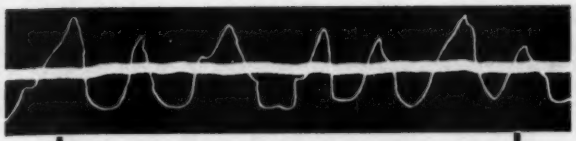
Blue Streak



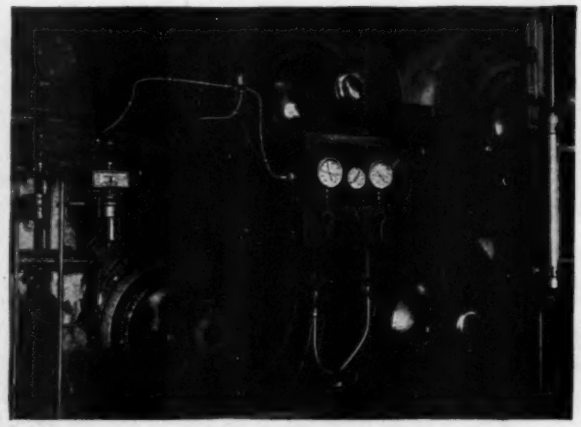
Red Streak



Load King



The New Stickle Tension and Thermal Control
REMOVES THE HILLS AND VALLEYS FROM YOUR FLOW METER CHART



● The New Stickle Tension and Thermal Control (illustrated in above installation) makes possible more uniform drying, improved quality of product and increased production efficiency.

Moisture control within a variation of one-half of one per cent is guaranteed. Authenticated tests made on various installations have indicated actual control performance usually to be within closer limits, as, for example, tests on 4.8 Bleach Gray Linen Condenser Paper shows a variation not to exceed one-fourth of one per cent.

Mills now operating paper and board machines equipped with Stickle Drainage and Controls report savings of 400 to 1200 pounds of steam per ton of paper dried. A steam saving of around 20 per cent usually is obtained. This record of operating results, based on installations in a large number of mills, reflects a fairly accurate range of possibility for decreased steam costs, and between the two figures given doubtless lies the saving Stickle Equipment will obtain for you.

The stabilization of steam flow and close control of moisture eliminate cockling, reduces curling and shrinkage and to a very great degree prevents drier snap-offs. Very little manual attention is necessary.

This Stickle equipment is simple in construction. There is no delicate mechanism to get out of order. All moving parts are visible.

Modern Stickle Equipment and the results it achieves are a result of more than 35 years of specialization on paper making problems as they relate to drainage, steam flow, steam pressure and heating efficiency. All equipment is installed on a positive guarantee.

Without obligation to you, one of our field engineers will gladly check with you on your drying problems. Ask for Bulletins 60 and 60C.

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Precision perforations in all sizes for large production and screen durability
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2—1196 HP Stirling boilers, 250-lb. pressure.
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of the different sections of the same distributor may vary from .005 cu. in. to .035 cu. in. By selecting the proper number and capacity of sections, and supplying the proper amount of lubricant to the inlet, a single distributor, discharging progressively through one outlet after another, will deliver the desired amount of lubricant to all the connected bearings even though the individual bearings have widely varying lubricating requirements.

The distributor can use either oil or grease, and it must discharge lubricant from each and every outlet or the operator receives immediate warning.

A distributor, fitted with a simple pressure lubrication fitting, can be mounted on a machine and all the connected bearings lubricated manually with a simple hand or "gat" gun, or a distributor can be fed from a discharge outlet of another distributor, or from a metering feeder of a Trabon reversing system.

A multi-outlet pump, designed for use with this non-reversing system, has one, two or three outlets, each connected to a separate cylinder so the quantity of lubricant delivered through any pipe can be varied without affecting the other pipes.

Pipe Line Filter

A pipe line water filter of radial fin construction known as *Model CPHLS*, has been announced by the Staynew Filter Corporation, Rochester, N. Y. Among the advan-

tages of this filter, cited by the manufacturer, are: no moving parts; large filtering area; filtering insert easily removed; and cleaning can be effected by backwashing with clean water, if desired.

Floor Patching Compound

A compound for patching concrete floors, has been announced by The Truscon Laboratories, Caniff & G. T. R. R., Detroit. Known as *Floor Patch*, the compound with a color approximating that of normal concrete requires only the addition of water for an application. It is adaptable to quick, overnight repairs.

Metallizing Gun

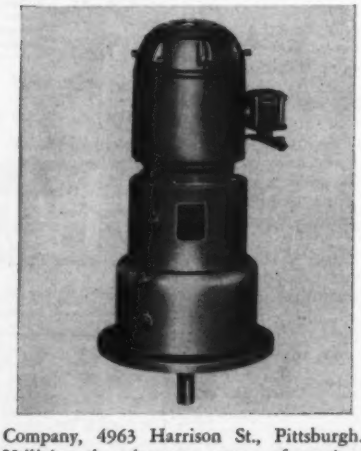
A new type of metallizing gun, known as *Metco Metallizing Gun-Type 2E*, has been announced by Metallizing Engineering Co., Inc., 21-07 41st Ave., Long Island City, N. Y. The gun, according to the manufacturer, has two new outstanding features, a controlled power unit and a universal gas head. The power unit controls the wire speed by means of a governor which allows full power input at all times. The gas head allows operation on any of the usual fuel gases with balanced pressures without changing heads or dismantling the gun in any way.

The gun, weighing only 4¾ lb., may be used as a hand tool for coating large structures with zinc, aluminum, lead or other metals; or as a lathe tool for building

up worn shafts, rolls, plungers, etc., with steel, stainless steel, Monel metal, bronze or any other metal obtainable in wire form. The metal wire is fed automatically into the gun at an adjustable speed, where it is melted by means of concentrated flame, atomized by compressed air, and sprayed on any base metal.

Agitator Drive

An agitator drive, designated as *The Portereducer*, has been introduced by the Process Equipment Division, H. K. Porter



Company, 4963 Harrison St., Pittsburgh. Utilizing the planetary system of gearing, the unit, designed to use NEMA frame motors, may be obtained in a size range from ½ hp. to 50 hp.

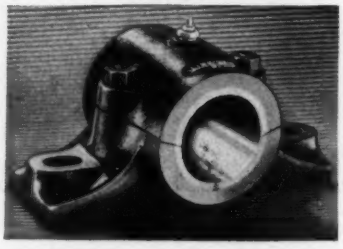
High-Pressure Spiral Packing

A high-pressure spiral packing with outer layer impregnated with lubricant forced into the packing by a hot pressure process has been announced by Greene, Tweed & Company, 101 Park Ave., New York City. The packing, known as *Palmetto High-Pressure Spiral Packing*, is made of closely woven asbestos cloth with center block laid up against a flat strip of heat-resisting, resilient red rubber. The cover or wear face is bonded to the center to make a square cornered packing. The packing is spiraled on a mandrel and vulcanized, and the lubricant is then applied.

Regularly furnished in standard 12½ ft. spirals, the packing, according to the manufacturer, is specially adapted for reciprocating rods and plungers of steam engines and pumps, air and gas compressors, and various special machinery.

Babbitted-Bearing Pillow Block

A babbitted-bearing pillow block with maroon-colored crackle-finish housing has been announced by Link-Belt Company, 2410 West 18th St., Chicago. Designated as *Series 2-1200*, the pillow block is designed for moderate speed and power requirements and is available for shafts of ½ to 3 in. in diameter. Among other design features, cited by the manufacturer, are the following: Removable shims be-



tween base and cap provide for needed adjustment. Bearing ends are finished to provide accurate bearing surfaces for collars, pulleys, gears, sprockets, or other limiting devices. Base is accurately ground to very close tolerances, maintained from base to bore center. Elongated holes for base holding-down bolts provide adjustment for shaft alignment.

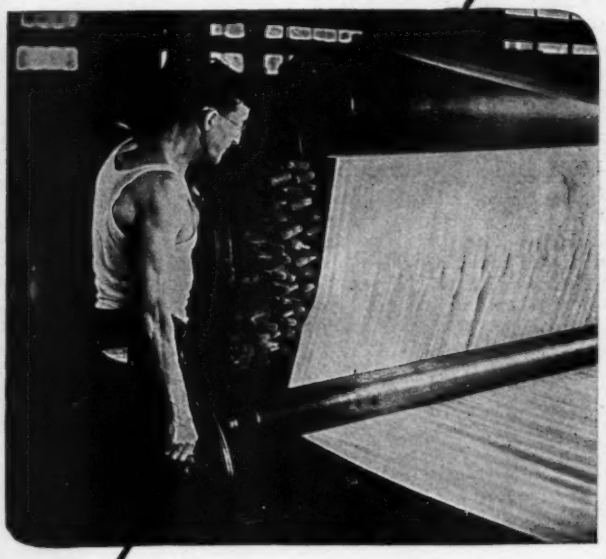
Perspiration Retainer

Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh, Pa., has announced a perspiration retainer for workers on hot jobs. The retainer, designated as the *M. S. A. Coolband*, consists of a soft, flexible band which encircles the head. Any part of the band can be wrung out quickly by merely pulling the band away from the head and squeezing. The retainer also may be washed and disinfected easily.

Open-End V-Belting

The B. F. Goodrich Company, Akron, Ohio, has announced a line of open-end V-belting for application on drives where endless V-belts cannot be applied readily. The open-end V-belting is made in maximum 50-foot lengths; in top widths of 2$\frac{3}{32}$ in., ⅞ in., and 1¼ in.; and in thicknesses of $\frac{7}{16}$ in., ⅝ in., and ¾ in. The angle in each case is 40 degrees. Metal fasteners are used.

...HERE'S THE WAY ORR PUTS A NAP ON A FELT



Little thistle like teasels, specially grown for Orr Felt in Oregon, are placed on a revolving drum. Their stiff points dig into the felt as it passes by, raising the wool fibres to form a nap.

This operation is far more difficult than it may appear. For one thing, it requires a trained operator, like this twenty-year veteran, to handle the controls. Then, each different type felt requires a different treatment—depending on the type of nap desired.

The care taken to nap an Orr Felt correctly is typical of the care taken in all Orr Felt departments. The result—felts superior by actual comparison—felts that will show you the true meaning of long life and thorough water removal. Next time, specify Orr Felts.

Orr Felt & Blanket Co.
PIQUA, OHIO

TALK ABOUT A TAILOR MADE VALVE for ALUM SERVICE This is it!

HERE'S WHAT A LARGE OREGON PULP AND PAPER COMPANY SAYS:

"Some four years ago we purchased Hills-McCanna Valves for our alum system and they have given us excellent service. The diaphragms have been in constant use and have given no trouble whatsoever."
Such service records are not uncommon with these valves. They will outperform conventional valves wherever installed, handling pulp, liquors, bleaches, alum, sizes, saponifiers, casein, dyes or silicates. Write for Bulletin V-40-A.

HILLS-McCANNA CO., 2433 Nelson St., CHICAGO

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SAUNDERS' PATENT
VALVES

GLAUBER'S SALT

A Limited Supply Available for Early Delivery

SODIUM SULPHATE
SALT CAKE-SALT

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The best for leather, rubber and cotton belting.
Potter's Patent—Every Hook Guaranteed
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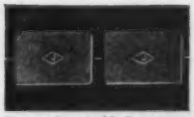

Two Jewell Potter Hooks after being driven through the belt.

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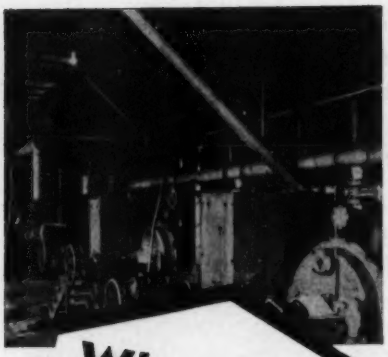

What other pipe could handle this job as well?

This trim installation of Taylor Spiral Pipe is simply one of the many applications for this sturdy, but light-walled pipe that no other type of pipe can handle as well or as economically.

More and more it is becoming apparent that Taylor Spiral is the paper mills' most versatile pipe. It is the easiest to install in the first place, the easiest to handle when conditions are changed, the most economical to buy and to maintain.

Whether it is a simple layout, or the most intricate layout requiring special fabrications, Taylor Forge has the answer to your piping requirements. Always remember that Taylor Spiral Pipe is about 50% lighter than ordinary wrought steel pipe and over 50% cheaper when installed.

TAYLOR FORGE & PIPE WORKS
General Offices and Works:
P. O. Box 485, Chicago, Ill.
New York Office: 50 Church Street

ASK FOR NEW CATALOG

TAYLOR Spiral PIPE

TECHNICAL DEVELOPMENTS

The following abstracts are of the latest developments found in the foreign press.

Testing Press Boards of Various Compositions

A long series of experiments with "Presspahn" were carried out at Darmstadt. Various stocks (16 in all) were used in forming the pressboards, and actual manufacturing conditions were obtained by cooperating with a pressboard mill. The preparation of samples is described in detail. Stocks used included 100% Scandinavian sulphate, 100% German sulphate, various types of sulphite, waste paper containing rag stock and free from groundwood, waste paper containing neither rags nor groundwood, waste paper containing mechanical pulp, 50-50 Scandinavian sulphate and sulphite, 50-50 Scandinavian sulphate and waste paper containing rag stock, 50-50 Scandinavian sulphate and waste paper free from rags and groundwood, 50-50 Scandinavian sulphate and waste paper, containing groundwood, 50-50 sulphite and waste paper containing rag stock. Using the minimal values demanded by the Association of German Electrical Engineers (VDE) as standard for flat pressboard and superior pressboard (Edelpressspahn) the authors determined the breakdown voltages of sample boards treated as follows:— (a) dried directly, (b) folded then dried, (c) dried then folded, (d) dried then steeped in oil.

Measurements were made both for cross and machine directions. The authors also determined the inner resistance in M ohms, following in either case the methods outlined by the DVE. Mechanical tests were also made and these included:—area weight (g/m^2); thickness; volume-weight (kg/dm^3); % ash; tensile strength and stretch (in cross and machine directions, with folded and unfolded samples); folding endurance (in both directions) and the use of Eriksen's metal sheet tester. Heat resistance was also determined. The results are tabulated and reproduced graphically (giving comparisons with the minimum VDE requirements).

Samples made from the following met all the requirements of ordinary as well as superior Presspahn:—Scandinavian as well as German sulphate (with the latter fully equal to the former); several good brands of sulphite; 50-50 mixtures of Scandinavian sulphate and any of the following—good sulphite or wood-free rag paper, or waste paper free from groundwood and rags. Two other combinations met the requirements for ordinary but not superior pressboard. Tests showed that the most unsuitable conditions for electrical use were when samples were dried and then folded. Mechanical strength also decreased in samples folded prior to drying. Certain types of sulphite and wood-containing waste papers gave the weakest boards. The greatest tensile strength was always manifested in the machine direction. The authors also discuss the requirements of the VDE. Eleven graphs are given. W. Brecht and H. Schröter. Papier-Fabr. 38, 129-39; 141-6 (1940).

Pulp and Paper from Potato Tops

That some large scale experiments on the manufacture of pulp from potato tops in Germany have been carried out is indicated in a series of papers. When mixed with straw this raw material lends itself to the production of coated paper. Pulp yields however are relatively low, and careful utilization of wastes and recovery of chemicals are essential. W. Schieber. Vierjahresplan 4, 695-7; P. Reinhold, Ibid. 699-700; R. Peuckert, Ibid. 697-8 (1940). Through C.A. 35, 2717 (1941).

Cellulose Derivatives Used in the Paper and Board Industries

An outline is given of the properties and uses of cellulose esters and ethers which enter the conversion of products in these industries. They are used largely as lacquers, impregnating materials and adhesives. They include the cellulose acetates, nitrate, mixed esters (like the acetobutyrate), glycolcellulose, and methyl, ethyl and benzyl ethers. The dibenzylcellulose is very resistant to alkalis, acids, and to the passage of water vapor. This resistance to the passage of water vapor depends not only on the properties of the derivative but on the strength and freedom from porosity of the coating film. Lacquering is best carried out with calendered paper. For maximum vapor proofing at least two coats and if possible two different supplementary lacquers are advocated. Fritz Ohl. Wochbl. Papierfabr. 71, 641-4 (1940).

Flax and Hemp Fibers in Papers

This article deals with their differentiation by the use of the polarizing microscope, with the insertion of a gypsum "Red I" platelet. In either case, characteristic interference colors appear, but at the orthoganal position the order of appearance is exactly opposite for hemp than what it is for flax. This allows for their differentiation, even when the original fibers are completely bleached. The method is fully described. Provided it is closely followed, hemp and flax fibers in papers may also be distinguished from each other, unless the fiber structure has been completely destroyed. A. Herzog. Wochbl. Papierfabr. 71, 640-1 (1940).

"INDEX" TO BETTER QUALITY PAPER

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Caustic Extraction in Bleaching
Cooking Wood
De-inking
Digestion of Plant Material
Grinding Wood
pH Control
Size Manufacture

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Salt Cake Substitute (with gypsum)
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FOR TECHNICAL SERVICE . . . In the Solvay laboratories, actual pulp and paper men with years of practical experience in pulp and paper mills study your problems and make sample runs of pulp as the basis for recommendations. *Solvay will be glad to send these pulp specialists into your plant to study actual operating conditions and help adapt laboratory findings to specific plant conditions.* Write today.

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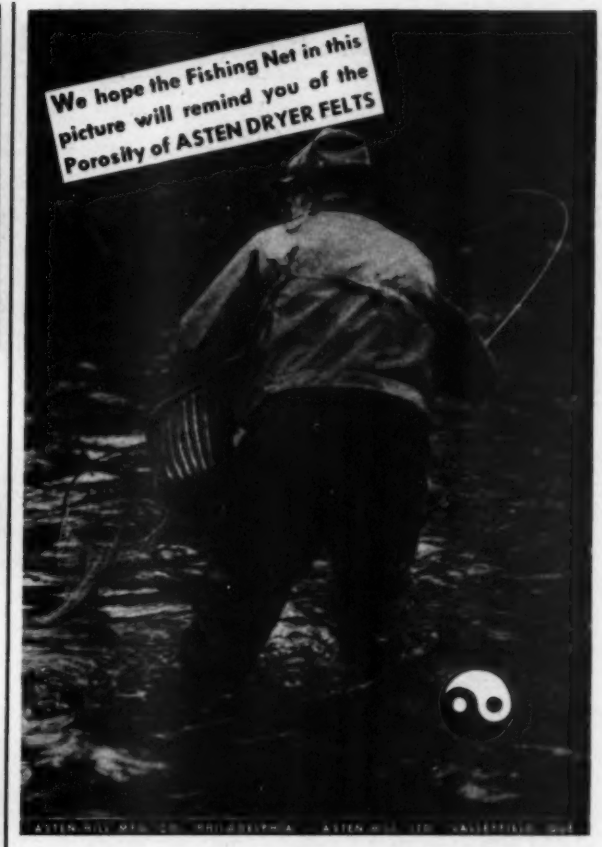

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New Catalogues and Association Reports

Acme Steel Co., Chicago—This company has just issued a publication dealing with the applications of the Acme Unit-Load, used for bracing commodities while being shipped. The booklet tells a vivid and extensive story, using illustrations on every page, of how the bracing strapping is used in such industries as paper, forest products, chemicals, machinery, steel, etc.

Brown Instrument Co., Philadelphia—A new catalogue (No. 77-1) describing a line of industrial power units and motorized valves has just been issued by this company. Many illustrations are used and actual photographs of electric control motors, slip steam globe type, rotary stem globe type, butterfly type, pilot operated, three way and special valves. Dimension tables and schematic diagrams give an accurate idea of workmanship and operation.

B. F. Goodrich Co., Akron, Ohio—A catalogue section (No. 2150) just published by this company, entitled "Selection and Maintenance of Rubber Transmission Belts" gives this subject a thorough and simple treatment, so that it is no longer an engineering problem to select or maintain these belts. The pamphlet also contains information on the latest developments in the treating of belting. Tables are used extensively to simplify the descriptive material.

General Electric Co., Schenectady, N. Y.—This company has just released four new folder-type publications. The first (GEA-3539) discusses the use and operation of the heating cable, listing the various applications together with specifications. The second, (GEA-2456) gives a story of how various factories and industries have, by the use of combination starters, cut down cost on control. The third, (GEA-3571) uses a labeled diagram of the new G-E plugging switch and explains, clearly, how time may be saved. The fourth, (GEA-2176) deals with selsyns for remote signaling, control, and indication and lists their applications. A description of the machine and its operation together with its mechanical features is included.

Hercules Powder Co., Wilmington, Del.—A 12-page booklet containing technical data on Flexalyn, diethlene glycol diabietate, has been issued by this company. The booklet gives data on acid number, melting point, color, density, refractive index, saponification number, etc. Tables of physical properties and typical formulations are included. It is stated by the company that Flexalyn is used as an aid in transparentizing paper.

Ideal Commutator Dresser Co., Sycamore, Ill.—A catalogue, describing and picturing many of the new products now being manufactured by this company, has just been issued. Some of the products that are discussed are: electric etchers, solders, an A. C. electric arc welder, lamp changer, etc. Many illustrations are used to describe the machinery.

Interchemical Corp., New York—A new booklet entitled "More Than Meets The Eye," which describes recent advances in the field of decorative and protective coatings is being distributed by this company. The chemical coatings discussed include printing and lithographic inks, gravure inks, industrial finishes, metal decorating materials, various office supplies, artist supplies, etc. Seven large color pages indicating the numerous uses are included in the booklet.

Lawrence Machine & Pump Corp., Lawrence, Mass.—This company has issued a new bulletin (No. 207-2) describing the slurry and sludge pumps made by this company. It is stated in the booklet that this pump is adapted for handling slurries containing solids in suspension. A diagram is included with specifications of the operating parts of the pump. A table on the sizes and capacities of the pumps is also contained in the bulletin.

Metallizing Engineering Co., Inc., Long Island City, N. Y.—A well-illustrated bulletin (No. 42) describing the metallizing process and equipment of the company has just been issued. The Metco metallizing gun is discussed in detail with diagrams and illustrations, also accessories used in this process are dealt with in this section of the booklet. The second division is devoted to a pictorial study of how this process is being used in the various industries.

Mathieson Alkali Works, Inc., New York—Thorough treatment is given to the subject of anhydrous ammonia in a booklet entitled "Mathieson Anhydrous Ammonia" which was recently issued by this company. The information contained in this booklet is intended to familiarize the reader with the chemical and physical properties of ammonia and the general precautions to be observed in its handling and application. Graphs and tables are used to supplement the reading matter.

Nash Engineering Co., South Norwalk, Conn.—A bulletin (No. 336) recently issued by this company discusses the Nash glass pump, a centrifugal of "Pyrex" brand heat, shock, and acid resistant glass. The various mechanical features of the pump are dealt with in detail, supplemented by large illustrations. Diagrams to show the specifications and charts to show the capacity of these pumps are included.

Oakite Products, Inc., New York—A pocket size booklet dealing specifically with modern Oakite cleaning methods for pulp and paper mills has just been issued by this company. Forty-one different pulp and paper mill cleaning jobs are explained, among these are: the cleaning of Fourdrinier and cylinder wires by three different methods, removing slime accumulations or pitch deposits from piping, screen plates, beaters, head boxes, save-alls, suction boxes, etc. There are also included many helpful pointers on general cleaning.

Reeves Pulley Co., Columbus, Ind.—A folder entitled "Hydraulic Automatic Control" has been issued by this company. This literature illustrates the application of this automatic variable speed control unit in the textile industry. Diagrams illustrate various mechanical details of the machine.

Joseph T. Ryerson & Son, Inc., Chicago—The new 1941 stock list Book, 268 pages, was recently published by this company. The features of this booklet are an enlarged complete main index, handy thumb tab margin indexes, helpful sub-indexes on all tab pages, eye-conditioned paper, and mechanical binding that assures flat, easy-turning pages. In addition to a complete listing of all Certified Steel products, the book contains SAE standard specifications, a physical properties chart showing machinability of more than 50 steels, standard gauge comparisons, weight tables, and other helpful data.

Sherwin-Williams Co., Cleveland, Ohio—The engineering story of Save-Lite White, a paint developed by this company, is contained in a booklet recently issued by them. All of the qualities of this paint are taken up together with its various functions. The latest developments in "Light Conditioning," and the part that this paint plays in seeing and lighting efficiency, are discussed in detail. Case history illustrations are used to show the before and after views of many of the jobs on which this paint was used. Charts are used to explain how the whitness is controlled and also how the loss in reflection value is cut to a minimum. Specifications are also included.

Signode Steel Strapping Co., Chicago—A pictorial study of many of the uses of the strapping manufactured by this company is contained in a pocket-size booklet recently issued by them. Illustrations are also used to show the various lithographed seals that are used on the strappings. Another section of the booklet is devoted to the machines used in the strapping of merchandise.

United States Stoneware Co., New York—A new booklet entitled "Tygon" has been issued by this company. This corrison-resistant paint for the process industries is discussed in detail with particular reference to the results of tests on a variety of acids, salts, etc., as to the resistance of Tygon to corrosive attack.

Westinghouse Electric and Manufacturing Co., Pittsburgh—This company has just published a 4-page folder describing a pin hole detector for showing up holes in sheet metal. The description covers the light source, photo-tube housing, and control unit. Three methods of removing holes after detection are also discussed. A tabulation of essential data, including sensitivity, length of stylus mark, etc., is included.

Association Reports

Legislation and Public Affairs—All member mills of American Paper and Pulp Association received a report on this subject signed by E. W. Tinker, executive secretary. Specifically, this report was sent out because a number of mills claim to have experiencd difficulty in obtaining replacement parts and equipment fabricated from metals vital to the defense industries, and the information conveyed in this release was given to clear up any confusion and misunderstanding relative to the manner in which priorities operate. Parts manufactured from nickel-bearing steel are a case in point. Under priority instructions already issued a *fabricator* of nickel-bearing steel products must file with each order for the basic metal Form P D 10. On this form the fabricator must indicate the preference rating to which he believes the order is entitled. (There are several preference ratings assigned to orders for nickel-bearing steel. Priority forms must be executed by the fabricator of the nickel-bearing steel product. The paper or pulp manufacturer who buys nickel-bearing steel parts does *not* need to apply for a preference rating.

Difficulties have also been encountered in the procurement of an adequate supply of chlorine. Conversations in Washington indicate that the situation with respect to chlorine may be increasingly acute. Priorities have not yet been put into effect and it has been indicated that they will be avoided if possible. Every effort is being made by the chemical representatives on the Defense Commission to expand the capacity for the production of chlorine. The limiting factor, however, is power. It has been indicated that chlorine production can be expanded in proportion to the expansion in available power. The chemical representatives on the Priorities Board advise that the consumers of chlorine should try to work out supply problems directly with their chlorine suppliers. If a paper or pulp producer is unable to obtain chlorine after diligent efforts have been made he should report the facts to the American Paper and Pulp Association and the matter will be immediately taken up through the industry's Defense representatives with the Chemical Section of the Priorities Division. In fact, the report further states that if serious difficulties are encountered in the procurement of any basic pulp or papermaking materials or supplies, the A. P. P. A. will be glad to be of service in establishing contacts with the proper Defense agency with a view to affording relief.

JOB WANTED

cleaning holding chests the easy, speedy Oakite way

If cleaning your holding chest is a job anything like that of one paper mill . . . then fast-working, thorough Oakite steam cleaning can help you!

Here . . . the former method was to scrub with long-handled brushes . . . a tedious, time consuming task. NOW . . . a solution of the recommended Oakite material is applied with the Oakite Solution-Lifting Steam Gun, Model No. 384. What a difference in results! Stock and dye are COMPLETELY removed in a fraction of the time formerly required . . . and at amazingly low cost!

Write for FREE 28-page booklet giving money-saving data on this and 41 other mill maintenance cleaning jobs.

OAKITE PRODUCTS, INC., 16 THAMES ST., NEW YORK
Representatives in All Principal Cities of U. S. and Canada

OAKITE *Certified* CLEANING

THE BEST DEFENSE IS IN QUALITY EQUIPMENT

The Hauser-Stander Tank Co.
Cincinnati, Ohio

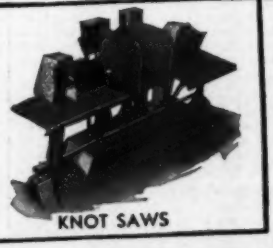
WOOD CLEANING EQUIPMENT

KNOT DRILLS

Wood Room equipment that keeps pace with the changes in the industry, backed by experience and service.

WOOD CLEANERS

Shown here are three items. Send for complete details on Murray wood cleaning equipment—and paper mill equipment too.



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H. Waterbury & Sons Co.
Oriskany, New York

COLORS . . .
for Board and Paper

Green Chromium Oxides
Black, Brown, Red, Yellow Iron Oxides
Lamp Black—Umbers—Venetian Reds—Yellow Ochres

C. K. WILLIAMS & CO.
Easton, Pennsylvania

CURRENT MARKET QUOTATIONS

RAGS (Domestic)
f. o. b. New York City

NEW RAGS

	per cwt.
Blue Overalls	4.25 to 4.50
Corduroy	2.25 to 2.50
Cottons—	
Washables, No. 1	2.00 to 2.25
Fancy Percales	3.50 to 3.75
New Soft Blacks	3.25 to 3.50
New Light Seconds	1.75 to 1.85
New Dark Seconds	1.50 to 1.65
Khaki Cuttings—	
Mixed	2.50 to 2.75
O. D.	3.00 to 3.25
New White Canvas	7.00 to 7.50
New Mixed Blacks	2.25 to 2.50
Shirt Cuttings	
New White No. 1	6.00 to 6.25
Silesias No. 1	4.50 to 4.75
New Unbleached	6.00 to 6.25
Fancy	2.15 to 2.35
Linen Cuttings—	
White	12.00 to 12.50
Grey	11.50 to 12.00

RAGS (Domestic)
f. o. b. New York City

OLD RAGS

	per cwt.
Roofing—	
No. 1	1.30 to 1.35
No. 2	1.00 to 1.10
No. 3	.90 to 1.00
Twos and Blues—	
Repacked	1.60 to 1.75
Thirds and Blues—	
Repacked	1.35 to 1.50
Miscellaneous	1.15 to 1.25
Whites, No. 1—	
Repacked	3.00 to 3.50
Miscellaneous	2.50 to 2.75
Whites, No. 2—	
Repacked	2.50 to 2.75
Miscellaneous	2.00 to 2.25

RAGS (Foreign)
ex dock New York City

NEW RAGS

	per cwt.
New Dark Cuttings	Nominal
New Mixed Cuttings	
New Light Silesias	
Light Flannelettes	
Unbleached Cuttings	
New White Cuttings	
New Light Oxfords	
New Light Prints	

RAGS (Foreign)
ex dock New York City

OLD RAGS

	per cwt.
No. 1 White Linens	Nominal
No. 2 White Linens	
No. 3 White Linens	
No. 4 White Linens	
No. 1 White Cottons	
No. 2 White Cottons	
No. 3 White Cottons	
No. 4 White Cottons	
Extra Light Prints	
Ord. Light Prints	
Med. Light Prints	
Dutch Blue Cottons	
French Blue Cottons	
French Blue Linens	
Checks and Blues	
Linsey Garments	
Dark Cottons	
Old Shopperies	

ROPE and BAGGING
f. o. b. and ex dock New York City

	per cwt.
Gunny No. 1—	
Foreign	Nominal
Domestic	4.00 to 4.25
Wool Tares—	
Light	3.85 to 4.00
Heavy	4.00 to 4.25
No. 1 Scrap Bagging	3.75 to 4.00
Manila Rope—	
Foreign	5.50 to 6.00
Domestic	5.50 to 5.75
New Burlap Cuttings	4.25 to 4.50
Jute Threads—	
Foreign (Nom.)	5.25 to 5.50
Domestic	4.25 to 4.50
Strings—	
Sisal	2.75 to 3.00
Soft jute	3.50 to 3.75
Mixed	1.20 to 1.40

WASTE PAPER
f. o. b. New York City

	per cwt.
Shavings—	
White Envp. Cuttings	3.25 to 3.40
Ord. Hard White No. 1	2.50 to 2.75
Ord. Soft White No. 1	2.20 to 2.40
Soft White, Extra	2.70 to 2.85
Flat Stock—	
Stitchless	1.10 to 1.20
Overissue Mags	.95 to 1.05
Solid Flat Book	.85 to .95
Crumpled No. 1	.75 to .85
Solid Ledger Books	2.00 to 2.10
Ledger Stock—	
White	1.65 to 1.75
Colored	1.15 to 1.25
New B. B. Chips	.50 to .60
Manilas—	
New Env. Cuts	2.75 to 2.90
New Cuttings	2.00 to 2.15
Sulphite Mill Wrappers	.55 to .65
No. 1 Old Kraft	1.35 to 1.50
Old Corrugated Boxes	.65 to .70
News—	
No. 1 Wh. News Cuttings	1.55 to 1.65
Strictly Overissue	.75 to .85
Strictly Folded	.80 to .70
No. 1 Mixed Paper	.47½ to .52½

CHEMICALS
f. o. b. shipping point

Alum (Papermakers)—	
Lump, cwt.	3.75-
Ground, cwt.	3.50-
Powdered, cwt.	3.90-
Blanc Fixe—	
Pulp, bulk, ton	35.00 to 42.00
Dry, barrels, pound	.0300 to .0400
Bleaching Powder—	
Drums, cwt.	2.00 to 3.00
Casein (Domestic Standard)—	
30-90 mesh (bags), lb.	19.00 to 20.00
80-100 mesh (bags), lb.	20.00 to 21.00
Argentine, lb.	19.00 to 20.00
China Clay—	
Domestic Filler Bulk (mine) ton	7.50 to 15.00
Domestic Coating Bulk (mine) ton	12.00 to 22.00
Imported (ship side) Bulk (lump) ton	15.00 to 26.00
Chlorine—	
Tank cars (wks) cwt.	1.75 to 1.90
Gelatine (silicia), lb.	.70 to .75
Glye. (C.P.) drums, lb.	.1250 to .1300
Litharge, powd., bbl., lb.	.08¼ to
Rosin (Gum)—	
New York, per 100 lbs.	
E.	2.53-
F.	2.53-
G.	2.53-
WW.	3.15-
Rosin (Wood), carlots	1.54-
Salt Cake—	
Dom. bulk (wks) ton	16.00 to 17.00
Imp. bulks on dock— (Atl. ports) ton (Nom.)	20.00 to
Soda Ash—	
Bulk (works), cwt.	.90 to .95
Paper Bags, cwt.	1.05 to 1.25
Barrels, cwt.	1.05 to 1.25
Soda (Caustic)—Ammonia,	
Solid, drums, cwt.	2.30 -
Ground and flake, drums, cwt.	2.70 -
Sodium Silicate—	
60 deg., 55 gal. drums, (works) cwt.	1.85 to 2.00
40 deg., 35 gal. drums, (works) cwt.	.80 to 1.45
Starch—	
Pearl, 140 lb. bags, cwt.	2.95-
Pearl, barrels, cwt.	3.05-
Paper (8p.) bags, cwt.	3.05-
barrels, cwt.	3.15-
Sulphur (crude)—	
(mine) bulk, long ton	16.00 to 20.50
Talc—	
Dom. 100 lb. bags (mine) ton	15.00 to 20.00
Imp. bulk, ton (Nom.)	—
Titanium Dioxide—	
Barium Pig., bbls., lb.	.05¼ to .05½
Calcium Pig., bbls., lb.	.05 to .05¼
Zinc Sulphide, bbls., lb.	.07¾ to .08

CHEMICAL PULP
(Air-dry ton)

	per cwt.
Soda (Dom.) del'd. mill—	
Bleached, contract	3.30 -
Open market	3.30 -
Sulphate (Dom.) f. o. b. mill—	
Bleached	4.25 to 4.50
Kraft No. 1	3.50 to 3.75
Kraft, Southern, del.	3.25 to 3.50
Sulphate (Imp.) on dock—	
Bleached	4.50 to 4.75
Kraft No. 1	3.75 to 4.00
Kraft No. 2	3.50 to 3.75
Sulphite (Fur.) On dock—	
Prime bleached	4.00 to 4.25
Prime easy bleach	3.75 to 4.00
Prime strong unbl	3.25 to 3.50
Sulphite (Dom.)	
Bleached, contract	3.62½ -
Bleached, open market	3.62½ -
Unbleached, contract	3.17½ -
Unbleached, open market	3.17½ -

MECHANICAL PULP
(Air-dry ton)

	per ton
No. 1 Dom. & Can. (f. o. b. pulp mill)	31.00 to 34.00
No. 1 Imp. (On dock)—	
Moist	—
Dry	—

PAPER
f. o. b. New York City

	per ton
Boards—	
Binders	78.00 to 82.00
Chip	45.00-
Chip, sgl. mls. lined	60.00-
Coated, white patent .016	80.00-
.020 and heavier	75.00-
Kraft liner	55.00-
News	45.00-

	per cwt.
Book (coated)	
No. 1 Glossy Coat	11.90 to 13.50
No. 2 Glossy Coat	10.25 to 11.75
No. 3 Glossy Coat	9.55 to 11.00
No. 4 Glossy Coat	9.15 to 10.50
No. 2 Offset	8.40 to 9.75
A Grade M. F.	7.20 to 9.50
A Grade Super	7.00 to 7.50
B Grade M. F.	6.70 to 8.75
B Grade Super	6.55 to 7.05
B. S. & S. C. Litho	6.80 to 7.30
B. M. F. Litho	6.95 to 9.00
Ivory & India	.50 cwt. extra
Bonds (Rag Content)—	
100% Rag Ext. No. 1	42.50 to 46.00
100% Rag	40.25 to 46.00
85% Rag	
75% Rag	26.65 to 27.75
65% Rag	
50% Rag	20.15 to 22.00
25% Rag	16.90 to 18.50
Regular Colors	1.00 cwt. extra
Bonds (Sulphite)—	
No. 1	9.25 to 11.50
No. 2	8.50 to 10.25
No. 3	8.05 to 9.25
No. 4	7.70 to 9.50
Colors	1.00 cwt. extra
Glassine (f. o. b. mill)—	
Embossed (25 lb. up)	14.00 to 14.25
Bleached (25 lb. up)	12.75 to 13.00
Unbleach. (25 lb. up)	11.50 to 12.00
Greaseproof—	
Bleach. (25 lb. up)	10.75 to 11.00
Unbleach. (25 lb. up)	10.00 to 10.25
Ledgers (Rag Content)—	
100% Rag Ext. No. 1	40.25 to 47.25
100% Rag	32.20 to 37.75
85% Rag	29.00 to 35.00
75% Rag	24.75 to 29.00
65% Rag	21.65 to 26.25
50% Rag	18.70 to 22.75
25% Rag	15.80 to 19.25
Regular Colors	1.00 cwt. extra
Ledgers (Sulphite)—	
No. 1	11.55 to 12.75
No. 2	9.65 to 11.75
No. 3	9.20 to 11.25
No. 4	8.90 to 10.75
News—	per ton
Rolls (Contract)	40.00 to 50.00
Rolls (Spot)	(nominal)
Sheets	58.00 -

	per ream
Tissues (Carlots)—	
White, No. 1	.07¼ -
White, No. 2	.75 to .77½
Anti-Tarnish M. G.	.80 to 1.05
Colored	.87½ to 1.10
Kraft	.85 to .90
Manila	.77½ to .80
Napkins, semi-crepe (12¼ lb. to M shts.) per cs	.41 -
Napkins, full crepe and emb'sed (12¼ lb. to M shts.) per cs.	.43½ -
Toilet, Bleached (M shts.) per cs	5.80 -
Toilet, Unbleached (M shts.) per cs	3.50 -

	per case
Towels—	
Bleached	3.10 to 3.65
Unbleached	1.95 to 3.30

	per cwt.
Wrappings (Kraft)—	
Extra Quality	5.50 to 6.00
Super-Standard	4.87½ to 5.50
Northern Standard	4.50 to 5.00
Southern Standard	4.50 to 5.00
Wrappings (Sulphite and Bleached Kraft)— (Rolls, f. o. b. mill)	
Bleached papers—	
M.F.& M.G. Waxing, 30 lb. (Carloads only)	6.65 to 7.00
(10,000 lbs.)	6.85 to 7.20
Drug wrapp. 35 lb.	6.50 to 6.75
Unbleached Papers—	
Com. Grd. Butch. 40 lb.	4.87½ to 5.12½
No. 1 Butchers	5.50 to 5.75
No. 1 Imit. Parch & Dry Fin.Groe.Sulphite 30 lb.	5.75 to 6.00
No. 2 Imit. Parch & Dry Fin.Groe.Sulphite 30 lb.	5.50 to 5.75
Steam Finish, 50 lb.	4.25 to 4.50
Water Finish, 40 lb.	4.87½ to 5.12½
Manilas—	
Envp. Mls., Sub. 16-40 (No. 1)	5.50 to 5.75
Envp. Mls., Sub. 16-28 (No. 2)	5.25 to 5.50
Envp. Mls. (Prices based on large sheets untrim'd reammarked, in bdls.)	
Wrapp. Mls. 35 lb. up—	
No. 1	5.50 to 5.75
No. 2	5.25 to 5.50
M. G. Sulphite and Kraft (other than Waxing)	
Grade A-25 lb.	6.25 to 6.50
Grade B-25 lb.	6.00 to 6.12½